WORK

An Illustrated Journal of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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WORK WORLD.

FARM labourers and domestic servants are the great want of the Canadian Dominion.

* *

A test has been made of Brown's 5 in. segmental wire gun. It withstood the powder pressure of 66,000 lb. per square inch.

* *

A Newcastle-on-Tyne firm have recently made, in one length of 10,670 yds., a tram cable, weighing thirty-six tons, for use in Australia.

* *

Experiments are being made for the manufacture of soap from used cotton waste. It remains to be seen whether the product will be worth the cost of extraction.

* *

The dynamo is replacing the battery to such an extent in telegraphy that its use will, it is thought, be universal in a few years. It is both cheaper and more efficient.

* *

English and Scotch iron-masters will find room in New South Wales. The Government have decided to call for tenders for 175,000 tons of steel rails to be manufactured within the colony from ores obtained there.

* *

Bricks are extensively manufactured in Japan for home consumption, but a small quantity have been exported as a venture to Vancouver, and should the demand justify further exportations, Japanese bricks could be shipped to British Columbia as ballast at nominal rates.

* *

A new American pavement consists of steel plates 3 ft. long and ¼ in. thick, flanged on the sides, and bedded in sand. These plates are laid from curb to curb across the street. The flanges are pinned together, and the plates perforated for drainage purposes.

* *

The use of natural gas as fuel in the rolling mills of America is declining on account of a shrinkage in the supply. In most of the works bituminous coal has been substituted, but in some places attempts to use gas-coal or petroleum have been made.

* *

Waterproof sheets of paper, united by a special paste, are being used for boot-soles, and the same material is to be tried for horse-shoes. Paper can hardly be regarded as a new material for boot-soles, although it is not openly specified in large contracts!

* *

Where cylinders exhaust into condensers, and in all cases where exhaust steam is used over again in the form of boiler feed-water, the boiler parts should be lubricated with the best cylinder oil and not with tallow. All tallow contains more or less acid, which is very injurious to boiler plates.

* *

Experiments recently made with liquid oxygen are of very great interest, and are to be extended. The comparative properties of oxygen and ozone can be further studied, and the question whether oxygen is an elementary or a compound substance ascertained. Come along, Royal Society!

* *

All interested in the "eight hours" question will watch its progress in America, as, if it is successful there, a great impetus will be given towards its adoption here, not only for miners, but for all labourers. President Harrison's signature, limiting eight hours for the work of the labourers and mechanics employed on public works in America, has gone forth. Room for the British Labour Party!

* *

The export of pig-iron from Swansea port last year was 646,000 tons less than in 1890. That of Bessemer steel had fallen to the extent of 46,666 tons, and "open-hearth" steel showed a decrease of 189,319 tons. This decline of exportation has unfortunately continued during the first six months of this year. Strikes have done this!

* *

When taking indicator diagrams from steam-engines, the atmospheric pressure should be considered. With regard to the economy of the engine, it is right to know how much the exhaust pressure is above zero. The atmospheric pressure is not always the same at sea-level, and at any altitude it is always less than 14·75 lb. per square inch. Many engineers neglect this important fact.

* *

Business is very brisk in Chatham Dockyard just now, and a large number of hands are daily working overtime. The ships absorbing the greatest number of hands are the first-class battleship, *Hood*, 14, 14,150 tons, 13,000 horse-power, one of the new Admiral type of vessels, and the twin-screw protected cruiser, *Hawke*, 12, 7,350 tons, 12,000 horse-power. What it costs for ironclads, and how little real use there is, or need be, for these weapons of offence and defence, the Peace enthusiasts will say!

* *

"Cutting it fine" is a known business experience. A French veneer-cutting firm have brought their machinery to such perfection that from a single tusk, 30 in. long, they can cut a sheet of ivory 150 in. long and 20 in. wide. Some of the sheets of rosewood and mahogany are only about one-fiftieth of an inch in thickness, and sheets of boxwood, maple, and other woods of this character are often so thin as to be translucent. The grain of many varieties of wood, however, is not sufficiently close to enable such fine work as this to be done.

* *

A new process for obtaining aluminium is the outcome of seven years' experimenting. The metal can be reduced from ordinary, fair quality clay, all iron and silicon being efficiently removed. It is hoped to produce 5,000 lb. of aluminium a day with plant driven by 5,000 horse-power motors, and this at one-quarter of the cost now incurred. When it is remembered that the specific gravity of aluminium is 2·5 compared with 8·9 for copper, it seems probable that the latter metal will, for many purposes, be superseded by the former, and as it is not so corrodible satisfactory results may be expected.

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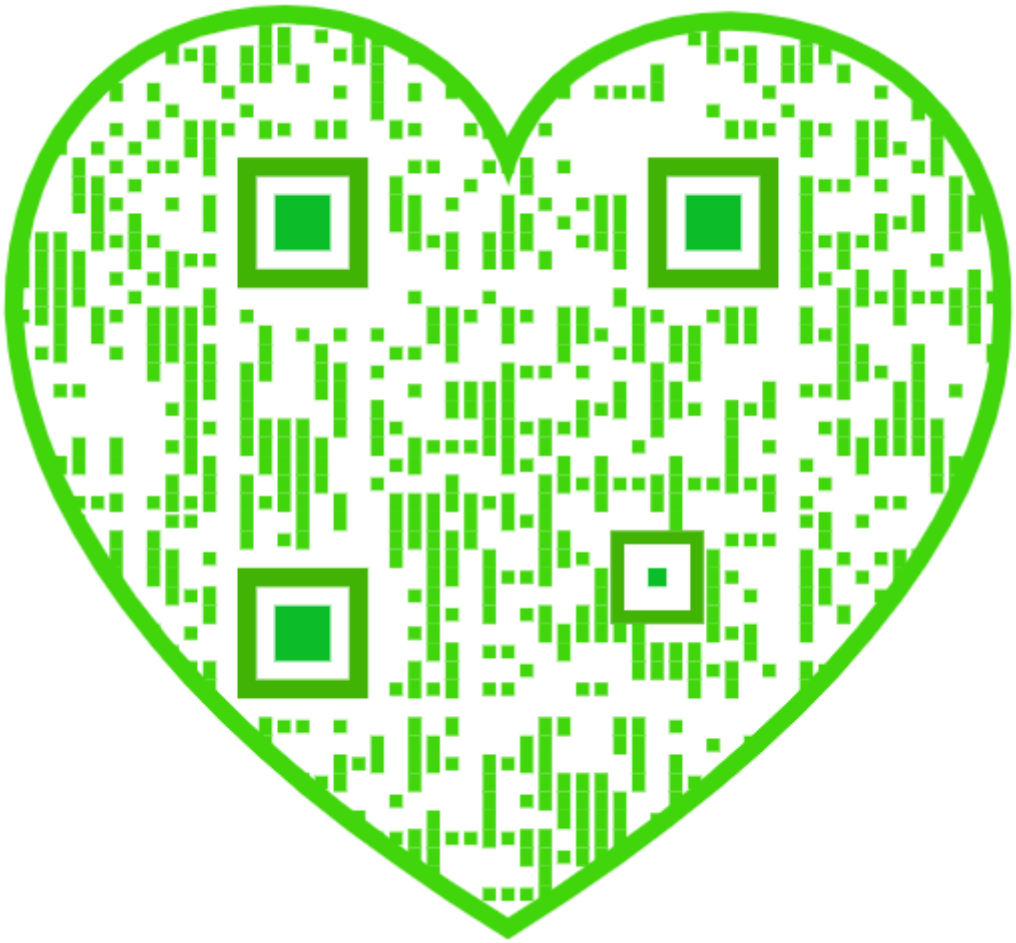

MAKESHIFT COMBINATION WORK-BENCH.

BY CLERICUS SECUNDUS.

NECESSITY is the mother of invention, saith the proverb. It is also the mother of many a makeshift which the proud amateur looks upon as a hardly inferior kind of invention.

Nor is it necessarily a disagreeable necessity. Of course, it might be more pleasant to have only to write to Messrs. Melhuish & Co. or Messrs. Syers & Co., and order a compact or complete bench (according to taste or circumstance), but many considerations may block the way to such a transaction and throw the luckless (?) amateur back on himself and such powers of getting out of a difficulty as Providence may have given him. In that case the best thing he can do is to practise the French proverb: "If you have not what you would like, you must like what you have," and there is a distinct pleasure, which the favourites of blind fortune never know, in having to pit one's brains against the difficulties of one's circumstances.

Being called to a somewhat distant field of labour, I found the cost of transit such that I must needs part with the humble but solid work-bench at which I had whiled away many a pleasant hour. What I should do at my journey's end, I knew not, but, Micawber-like, waited to see what would turn up.

Having reached my destination, the half-hoped-for second-hand bench did *not* turn up. Experience, expediency, and expense alike forbade the purchase of a new one, and yet a bench I must, would, and should have.

The outcome of the dilemma is now before the reader in the hope that—

> "Some forlorn and shipwrecked brother,
> Seeing may take heart again."

It is so unlikely that my exact conditions will be met with by any brother-amateur, that details of size, etc., would be practically useless, and are not given. Suffice it that my bench is 6 ft. long, 32½ in. broad, and stands 3 ft. high.

The idea, simple as it is, will be found capable of considerable adaptation to circumstances, and if carried out substantially as follows, the bench will thoroughly answer its several purposes.

A number of packing-cases, boxes, and trunks of various descriptions being (alas!) among my permanent belongings, it occurred to me that I might perhaps be able to utilise some of them for the end in view.

My first idea was to take a couple of boxes or packing-cases, stand them on end, and fix some kind of bench top on them. Some of my readers may prefer to simply carry out some arrangement of this kind, but, as will be seen, mine was a little more elaborate.

I had by me two stout, well-made boxes with hinged lids, and decided to use these as the bases of my construction. On laying them on their backs, however (in which position I wished them to remain), I found that the lids, which are flush with the outside of the boxes all round, were prevented from falling back, the contact with the floor allowing no room for the play of the lids. So I got two covers of other packing-cases, about the same size as my boxes and of the requisite thickness, and screwed them down to the floor where the boxes were to stand, and a couple of inches back of the front line of these latter (Fig. 1, A). This, of course, gave the lids of the boxes the necessary room to work and rendered the interiors get-at-able.

I now screwed the boxes down on to the covers, driving the screws right through from the inside and further fixed them to the floor, at both ends and back, by means of angle irons, or brackets, two of which are shown in Fig. 1, C.

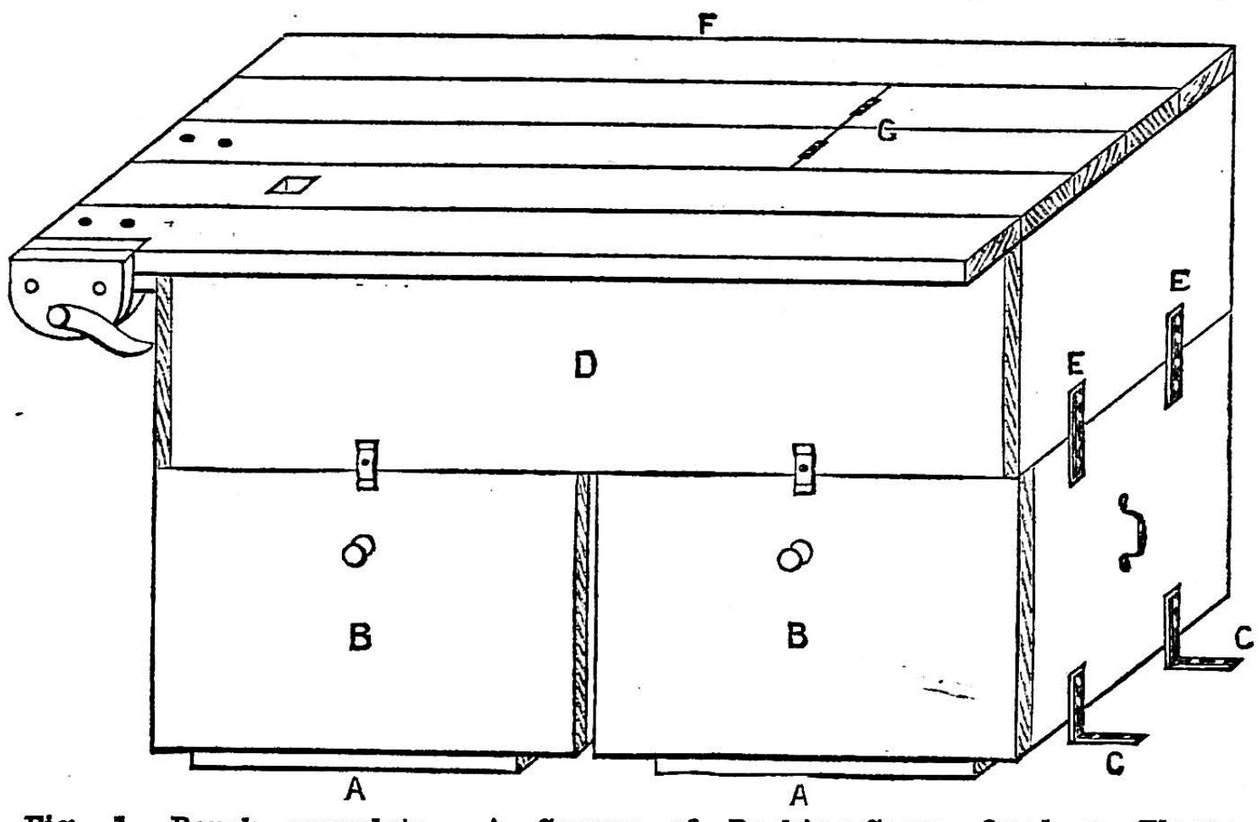

Fig. 1.—Bench complete — A, Covers of Packing-Cases fixed on Floor; B, Boxes fitted as Tool Chests; C, Angle Irons; D, Long Packing-Case fastened to Boxes; E, Strips to help fix ditto; F, Bench Top; G, Hinge Planks.

This was the more necessary because the workshop was right up under the roof, and that I had to fix the bench nearly in the middle of the floor to have standing-room. Of course, had I been able to fix it against a wall, the arrangement would have been somewhat easier and slightly different.

But my boxes, as they lay, were only 19½ in. high. As it was out of the question that the bench top should be so low, I proceeded to build on them. I had among my packing-cases a long one which had served to contain a baby's run and sundry lengthy etceteras, and this I now fixed on the top of my two boxes, its front being flush with the covers of the latter. A couple of buttons prevent the lids from suddenly falling back, and perhaps endangering the shins of the worker, whilst two small knobs facilitate the opening when required. The long case was firmly fixed by means of screws through the bottom and strips of iron all around (Fig. 1, E), the whole structure being thus made practically one, and as steady as could be reasonably desired.

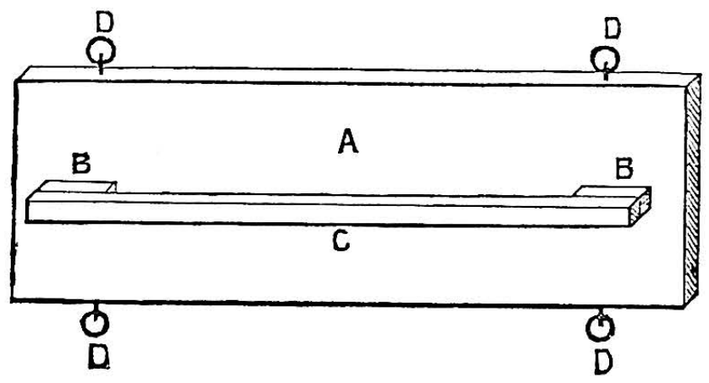

Fig. 2.—Tool Rack—A, Backboard; B, Blocks to carry Lath; C, Lath to carry Tools; D, Eyes for Screws.

My first idea had been simply to utilise the top of the case as the bench top, but unfortunately it was made of short ends of somewhat thin wood screwed on across the width of the case, and so was useless for the purpose.

I procured five planks of 1¼ in. deal. These, not including the tongues and grooves, were 6½ in. wide, and so gave a total width of 32½ in. As this was about 4 in. wider than my case, I arranged them so as to overlap in front, and supported the projecting part by screwing some angle irons underneath. Not wishing to lose all the space afforded by the long case, I hinged a couple of feet of the two middle planks (see Fig. 1, G). The space thus made available is most convenient for stowing away planes or other bulky objects—care being taken not to push them beyond reach—or the shavings may be swept into it instead of littering the floor.

The bench was now practically complete, except for the fittings. I decided to procure a patent instantaneous grip-vice and a patent bench-stop. Of course, I fixed the latter (easily enough) so as to be flush with the bench top when pushed down; but the vice presented an unlooked-for difficulty. It was meant for much thicker bench tops than mine, so that the jaws projected considerably above the level of the bench top.

To remedy this, I made the top the requisite thickness by screwing a plank-end across underneath its upper end where the vice was to be fixed. Four stout bolts right through the planks and vice, but with the heads sunk so as to be flush with the top, and an angle iron under the casting to take off the strain (the weight of the vice being considerable), completed this part of the job.

I also purchased a bench knife or back-stop, of the kind which are screwed to the edge of the bench top; but this is also meant for a top of average thickness, and the screw is not long enough to grip the edge of mine.

A strip of 1 in. wood along the underside of the front edge sufficed to make this all right. If, however, I were to begin again, I should get thicker wood, or (perhaps better) make the bench top of two thicknesses one across the other. This would obviate the inconveniences I have experienced, and effectually prevent the top from warping.

There now only remained the fitting up of the two boxes as tool chests. In this, of course, each reader will suit his taste or convenience.

In my case, as it is probable that sooner or later the boxes will be needed for their more legitimate purposes, it was best to have the whole interior arrangements easily removable. So the tools are fitted in racks similar to Fig. 2, which are fixed to the lids and sides of the boxes by small screws through the eyes. The remainder of the tools are arranged on movable shelves inside the boxes—an arrangement necessitated unfortunately by the dampness of my attic-workshop, which forbids any of the tools being left exposed.

The whole makes a useful and compact bench, and, for an amateur's makeshift, a neat and fairly workmanlike job. Some of the readers of WORK wanting a makeshift for a Melhuish bench may value this.

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SMALL TABLE IN ENAMEL.

BY H. J. MARK.

INTRODUCTION—TOP—TOP RAILS—LEGS—BOTTOM RAILS — UNDER FRAME — TRAY — CARVED PIECES—ENAMELLING AND FINIS.

Introduction.—The subject is a little in advance of my original whatnot, but is designed *en suite*, having some carved work introduced, and the framing is a little more complicated. It forms also a good study for dovetailing, tenoning, etc., as well as squaring. The wood used is deal, excepting the carved pieces and the turn buttons, shown in Fig. 6, for securing to the table top; these are mahogany, as I thought it desirable that they should be of a stronger wood. The table is also designed to take to pieces for reasons before stated.

Top.—This is made of two pieces of 9 in. stuff, ¾ in. thick, tongued and grooved. A very good series of articles by Mr. David Adamson on jointing up generally appeared in the monthly numbers of WORK for August, September, and October, 1889, and which I recommend my readers to peruse if unacquainted with the precise method of working. They will find his remarks very useful and instructive. These two pieces are glued together, and when dry, faced and trued up. Preparatory to gluing, however, I made a cramp similar to the one explained by "H.H." in "Means, Modes, and Methods," p. 730, Jan. 24, 1891, and by which I secured the top after gluing. Remember to wash off any glue that squeezes out beyond the joint, or that has been dropped by mischance on the board, else in planing you will most likely notch your plane. When the top is ready, strengthen the underneath side of the joint by a strip of wood 3 in. by ⅜ in., and screwed at alternate intervals with ¾ in. screws, taking care, however, that it is not longer than is necessary to bring it up to the inside edges of the top side rails. The projecting angle pieces at each corner are strips of ½ in. stuff nailed and glued, so as to form a whole with the table top, and mitre-jointed as shown in Fig. 4, by the outside dotted lines. It will be found advantageous, after fitting them, to work the grooves in their face, sides, and likewise in the top itself, as shown, before finally fixing them. To work the grooves more neatly in the end-grained sides of the table top, I nailed two pieces of ½ in. stuff on to each side, and the angle piece over that again; by this means I had clean cut grooves all round. Punch all nails, used here and elsewhere, in a little way, and fill up the holes with shellac melted into them by the application of a hot iron. This is better than putty, and will completely hide them.

Top Rails.—These are 2½ in. by ⅝ in., and are dovetailed into the legs, as shown in Figs. 5 and 6. They are not glued, but

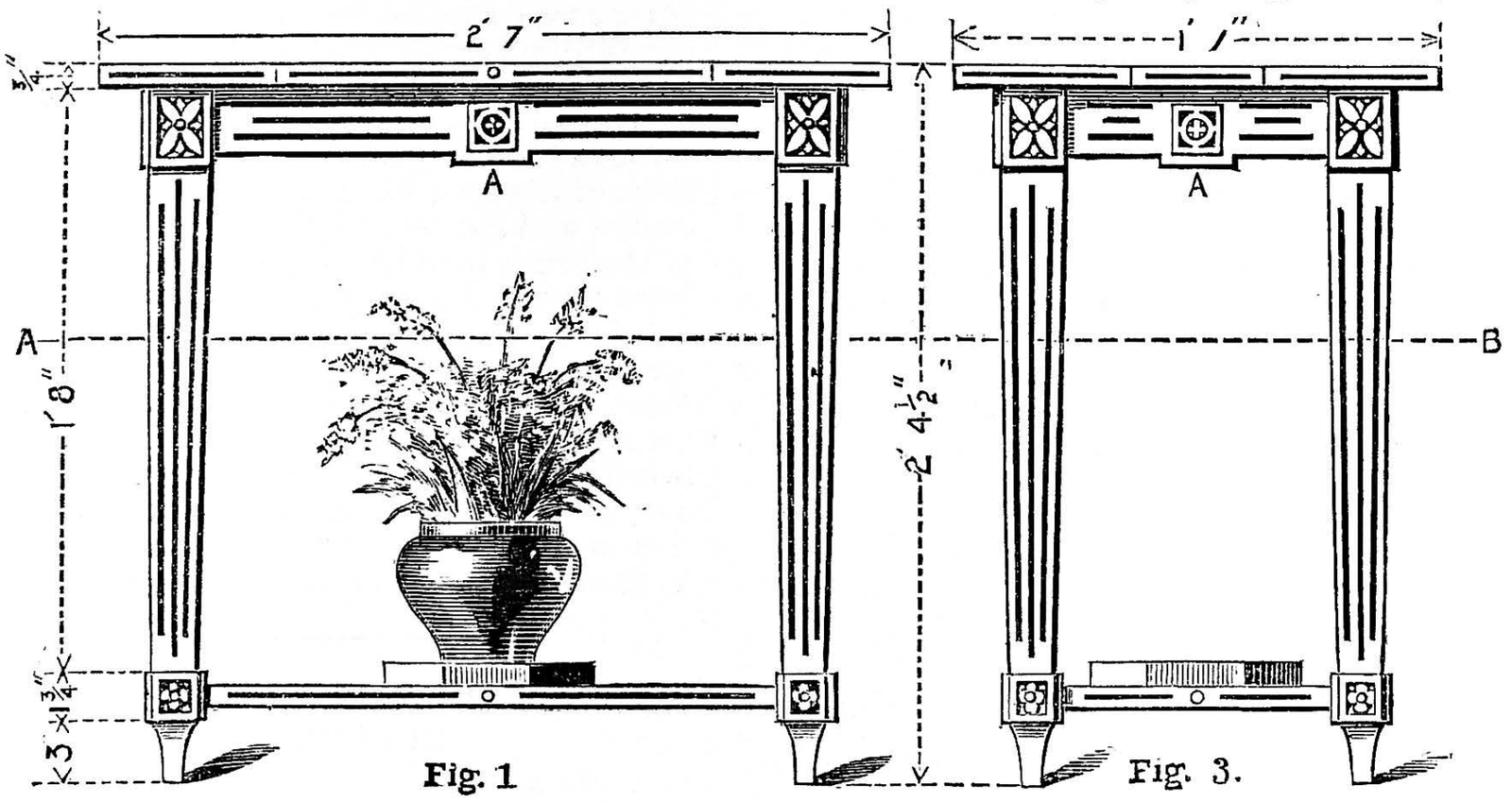

Fig. 1 Fig. 3.

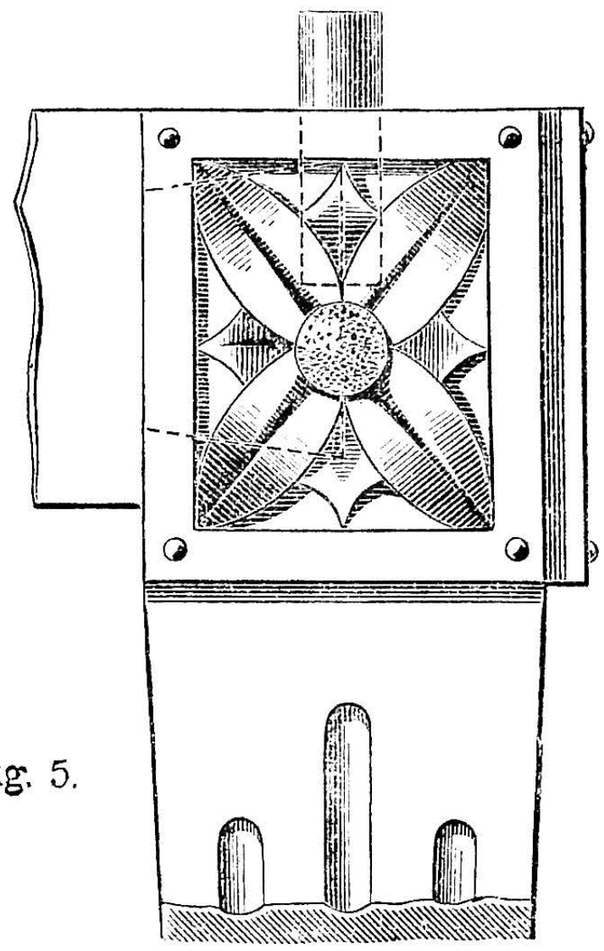

Fig. 5.

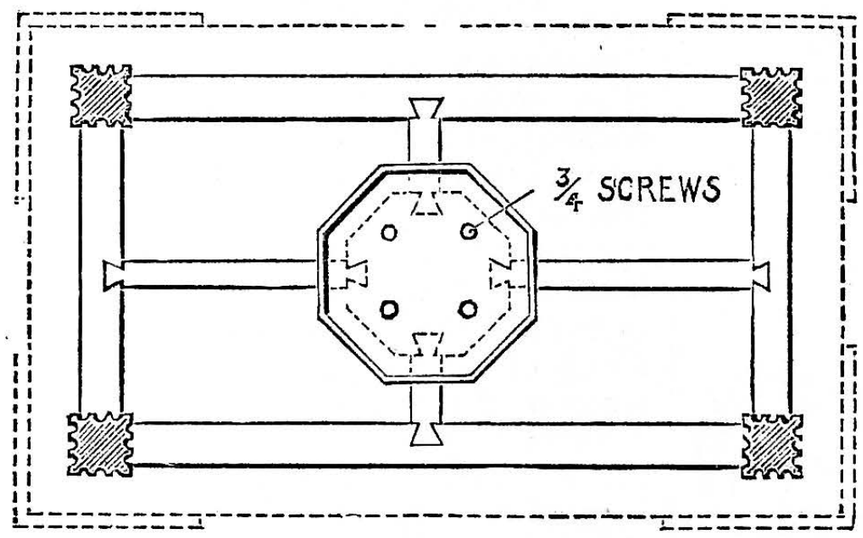

Fig. 4

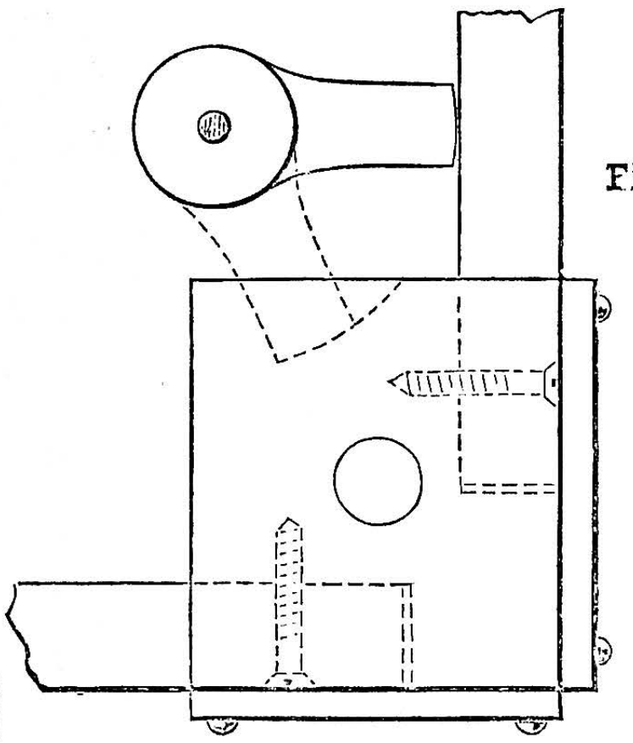

Fig. 6.

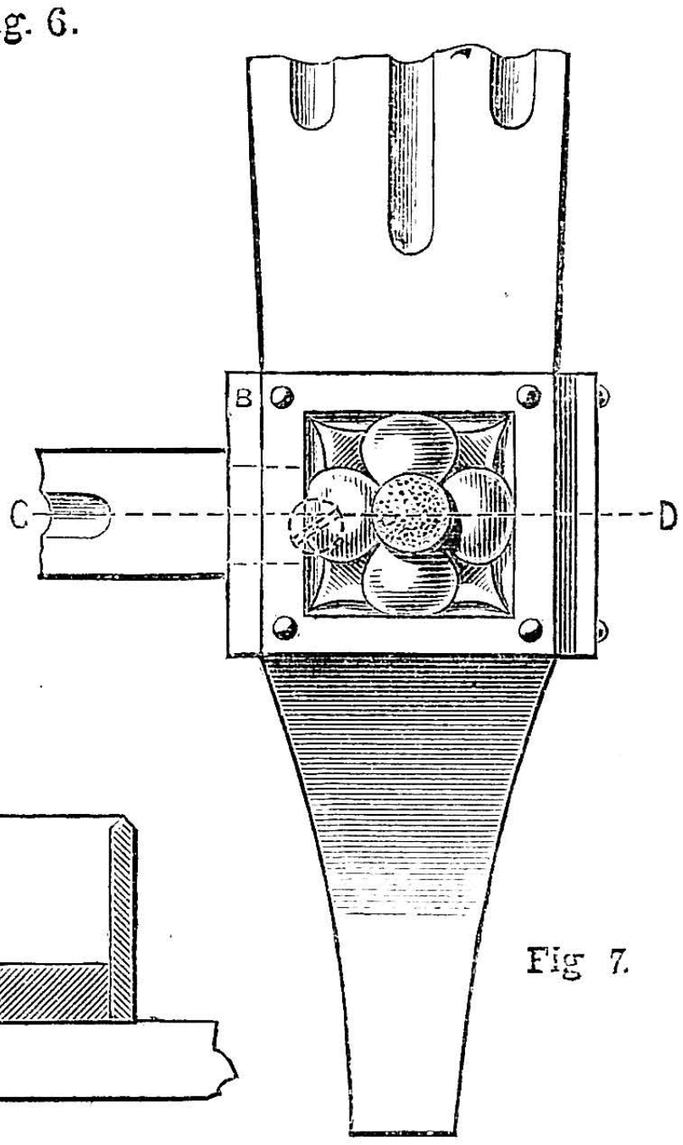

Fig. 7.

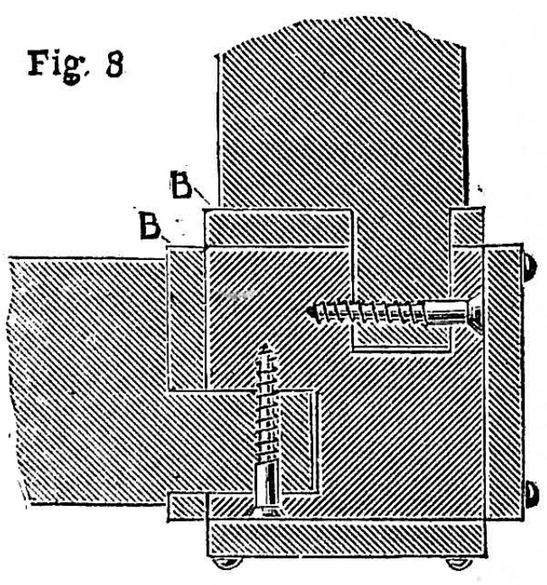

Fig. 8

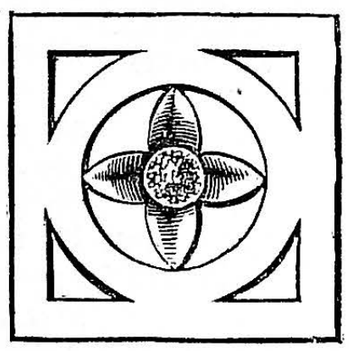

Fig. 2

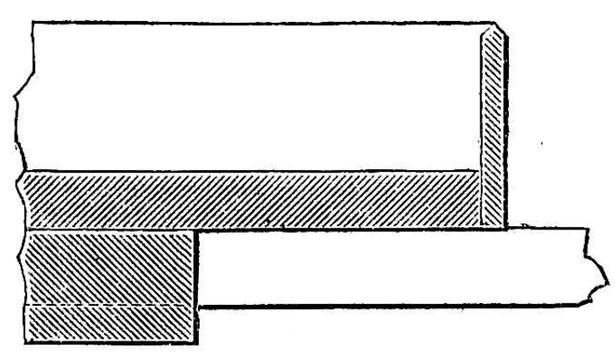

Fig. 9.

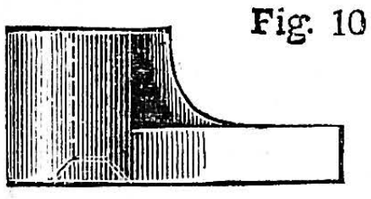

Fig. 10

Small Table in Enamel. Fig. 1.—Front Elevation. Fig. 2.—Carved Piece of Top Rail. Fig. 3.—Side Elevation. Fig. 4.—Sectional Plan on Line A B; Outside Dotted Lines show Plan of Table Top. Fig. 5.—Top Portion of Leg, Dotted Lines showing Dovetail of Top Rail and Depth of Dowel. Fig. 6.—Plan of Top Portion of Leg with Turn Button for securing Top, Dotted Lines showing Slot for Turn Buttons. Fig. 7.—Bottom Portion of Leg, Dotted Lines showing Tenon of Bottom Rail. Fig. 8.—Section on Line C D. Fig. 9.—Section of Portion of Tray. Fig. 10.—Turn Button.

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secured by 1¼ in. screws. The projecting piece, marked A in Figs. 1 and 3, is a strip ⅜ in. by ⅝ in., and is treated in the same way as those of the table top.

Legs.—These are 2½ in. square at top, and taper to 1¾ in., as shown in full-size details. All dimensions given, it must be remembered, are finished sizes, and in getting out the stuff allowance must be made for sawing, planing, etc. After truing up, strike a centre line down two opposite sides, set off the taper, and work down the two sides to it; then do the same for the other sides. The best way to set about this is to cut down with the tenon saw at end of taper, clear away superfluous wood with the chisel, and finish with the smoothing plane; take care to leave flat and square the part that takes the bottom rails. The two square pieces marked B, in Figs. 7 and 8, are glued on and fixed by small brads; the mortises for the bottom rails have to be cut through these as shown. Now proceed with the mortises and dovetails, shape the feet, and leave the grooves till last. The grooves are on all four sides of legs. To cut the dovetail mortise use the dovetail of top rail as a template; take care, however, to hold it at right angles to the leg. The mortises for the bottom rails must be cut before the tenons, as the tenons have to fit them, not they the tenons. The mahogany turn buttons shown in Fig. 6 for securing table top are 1 in. thick, and are screwed to the top of the table as shown, the screw passing through a free hole. They fit into a slot in the legs, shown by dotted lines in Fig. 6. Whereas the dowel pins prevent any horizontal displacement, so these pieces prevent the prospect of lifting the table, and carrying off the top only. The dowels are let into the leg twice their height above it (see Fig. 5). They are secured by glue, but should not be made too tight a fit, else when glued and driven in they may swell and perhaps cause a crack. They should be a tight fit for the table top. They should also preferably be made of mahogany, or some other hard wood, and can be worked round with the plane, using the appliance shown in Fig. 21, p. 136, May 16th, 1891. With a little care and sand-paper, and using also a template hole, made by the bit you are going to use, they can be got fairly true. Of course, they are made in one length, and the four dowels are cut from it afterwards. The dowels may be left to the last, and to be as much as possible on the right side in getting their centres true, proceed as follows:—After marking their centres on the table top and legs, tap into the table top centres four shoemaker's brads, leaving their heads projecting about $\frac{3}{16}$ in. Now, these points should exactly correspond with the centres on the legs. If they do not, your framework must be somewhere out of square and must be seen to, as the edges of the top must be equidistant from legs and rails all round, though if carefully fitted together the centres will fall on each other without much deflection. A $\frac{1}{32}$ in. out would never be noticed, except by an extremely critical eye—at least, not in this case.

Bottom Rails.—These are 1½ in. by ¾ in. The tenons are secured by 1¼ in. screws, as shown in Figs. 7 and 8. They must be a little less in length than the depth of the mortise, so as to allow the shoulders fitting up close.

Under Frame.—Having fitted the rails and legs together, proceed to make and fit together the under frame. The arms are ½ in. by 1 in., and are dovetailed to bottom rails and to an octagonal piece of ¾ in. stuff, indicated by dotted lines in centre of plan (Fig. 4).

Tray.—This is octagonal in shape, with a raised edge made by mitre-jointed strips of ⅞ in. by $\frac{3}{16}$ in. stuff, fitted round a ⅜ in. bottom piece, and glued and fixed by brads. This tray is screwed to the octagonal piece, as shown, by ¾ in. screws.

Carved Pieces.—Having taken all to pieces, sand-papered, stopped, and put by to dry (by-the-bye, why not try the filling recommended by Mr. David Denning, p. 167, May 30th, 1891? I intend doing so on my next piece of work, and I do not see why it should not answer; and, besides, it saves the double sand-papering), start on the carved pieces. These are of ¼ in. mahogany, and are best carved and fretted all in one piece, shaping out and fitting afterwards. The centre bosses represent the middle portions of flowers and are in relief, but kept rather flat. The speckling means punching. The petals issuing from them are slightly hollowed and sunk as shown by shading. The little under leaves are below the petals, and are worked accordingly. The pieces belonging to the legs (Figs. 5 and 7) are secured by means of ½ in. brass gimp pins, and are meant to be removed at any time for the purpose of screwing up or unscrewing the rails. The pieces for the centres of top rails are permanently fixed. These carved pieces should be stopped as well as the rest of the work.

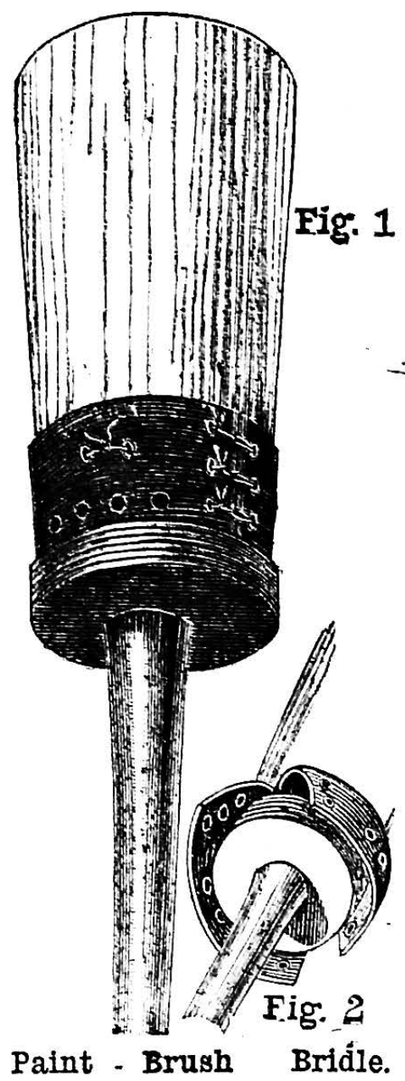

Fig. 1

Fig. 2

Paint-Brush Bridle. Fig. 1.—Perspective View. Fig. 2.—Bridle turned for Cleaning.

Enamelling and Finis.—Enamel in two coats. The main colour used is Arabian brown. The middle grooves of legs, top rails, small round centres of bottom rails, and table top; the bosses of carved pieces, and surrounding square and circle of centre-piece of top rails are in gold. All other grooves are in turquoise blue. All the petals are pink, and the leaves in bronze green.

The table could have a drawer added to it, or it could have a lid hinged in the top, and the space enclosed by the rails converted into a lady's work-box. A further improvement, by those who can do it, would be to paint at the four corners and in the centre some devices in oils or enamels, such as flowers, etc.

The table itself would look far better, and more artistic still, if made in walnut or oak unpolished, but that would mean just treble the cost, so I hope that in its present form it may prove acceptable. It is by no means inartistic when nicely made.

PAINT-BRUSH BRIDLE.

THE illustration shows an American patent designed for application to paint-brushes of all kinds, facilitating the working out of the colouring matter, and enabling the brush to be flattened as desired. Fig. 1 is a view in perspective, and Fig. 2 shows the bridle turned back in position for cleaning the brush. The bridle takes the place of the usual twine wound around the butt of the brush, and consists of two similar pieces or flaps, held at one end between the plug and the brush ferrule, the edges of the flaps having eyeleted perforations to be connected in pairs by cords. When the brush becomes worn, the outer ends of the flaps with the outer cords may be cut off to give further flexibility, as this may be desired. Near the centre of the flaps are other perforations to receive a cord extending transversely through the bristles and back again, portions of the cord lying at each side of the centre, and its ends being tied at one side. If the brush is to be round, the cord is left loose enough to permit the bristles to assume a cylindrical shape, but by tightening the cord the brush is flattened accordingly. Near the base of the flaps are perforations, through which the paint oozes when the brush is worked to and fro to free it of a certain colour, but when the brush is to be thoroughly cleaned, the flaps are turned back as shown in Fig. 2.

WATCH AND CLOCK CLEANING AND REPAIRING.

BY A PRACTICAL WATCHMAKER.

CLEANING A GENEVA WATCH.

FIRST thoroughly clean and dust the board; then spread out a sheet of clean paper, foolscap size, immediately in front of you, on which to put the small parts; arrange the tools mentioned in the last paper upon the bench, and seat yourself at such a height that when the arms rest upon the bench objects held in the hand are in easy focus of the eyeglass without having to stoop over them.

The first proceeding is to take the movement (works) out of the case. There are several methods of doing this, according to the kind of watch in hand; so I refer the reader to Figs. 11 and 12, a short description of which will not be amiss.

There are two ways of arranging the wheel-work in Geneva watches. Fig. 11 shows a "¾-plate" movement—that is to say, a brass plate, B, covers all the wheels, etc., except that part known as the "escapement," which will be referred to later on. In the other example (Fig. 12) the wheels are each held by a separate brass bar instead of a solid plate. This is termed a "bar movement." These two varieties, again, may be either "key winding" watches, as in Fig. 11, or "keyless," as in Fig. 12. The latter kind has the addition of various steel wheels and other mechanism, by which the watch is wound by means of the "stem," instead of placing a key directly upon the winding square.

Now, suppose we have in hand a key-winding watch. To get this out of its case, turn the turnscrew A (Fig. 11), or A (Fig. 12), and gently push the entire movement out of the *front* of the case. When this is out, several notches will be observed in the inner edge of the front of the case, and corresponding studs on the movement. In replacing it, these studs must first be placed in their respective notches, and the movement gently pressed in again till it is quite level, and the turnscrew A keeps it secure. It is just as well, before going any further, to take out the movement, replace it, and take out again, to familiarise yourself with the operation.

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In the case of a keyless watch, the small screw, B (Fig. 12), must be withdrawn first, then the stem, C, boldly pulled out, after which the turnscrew, A, may be undone, and the movement taken out as before.

The movement being out of its case, the next thing to do is to carefully examine it with the eyeglass before removing anything. Note carefully the exact position of every part visible, the way each piece is screwed down, etc.; this will be a great help when the time comes to put all together again.

Next proceed to take off the hands. Lever them up carefully by means of a pair of cutting nippers or a pocket-knife blade. They are all merely pushed on friction-tight. This done, the dial must be removed. In some watches the dial "feet," which pass through the watch plate, are held by turnscrews, as at D, D, Figs. 11 and 12, and in others they are simply pinned through, in which case the pins must be withdrawn with the small blade of the pocket-knife. The dial will then lift off free. If it does not, something is wrong, and a careful search must be made. *Use no force* in any operation appertaining to the taking apart of a watch, or damage will surely result. If parts do not come away easily, there is a cause, and that cause must be searched for with the eyeglass. Patience goes a long way in watch work.

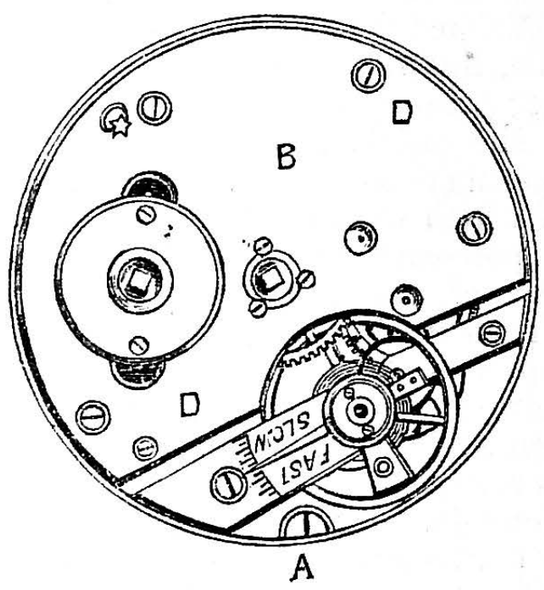

Fig. 11.—¾-Plate Movement.

When the dial is off, take off the two small wheels beneath it (called the motion wheels), turn the movement over, and see if there is any "power" on the watch—that is to say, is the mainspring wound up? If it is, and the watch will not go, it indicates that something is wrong, probably dirt in the wheel teeth or pinions. Under these circumstances it would not do to remove the balance wheel without first blocking the train wheels so that they cannot run. This is easily done by running a stout hair under the arms of the last brass wheel of the train, the fourth wheel, or that which drives the scape wheel—the one with peculiarly-shaped teeth. This done, unscrew the balance-cock or brass bar that holds the balance in position, and gently lift it by placing the point of the screwdriver under the notch cut in it for that purpose, and so levering it up. When this is free, the balance-cock, balance, and hair-spring should all come away together. If it appears to catch, shake it slightly; if this does not free it, turn the scape wheel the distance of half a tooth either way, which will most likely liberate it. Now replace the screw in its hole, and proceed to unscrew the scape wheel cock, lifting it in the same manner as before described, and remove the wheel. Take hold of the latter by *one of its arms* with the tweezers, and carefully deposit it in a place of safety.

The hair can now be removed and the train liberated. Let it run down slowly, using gentle pressure of the forefinger on the centre-wheel as a brake.

If the mainspring of the watch was not wound, or was broken, there would be no power upon the wheel-work, or tendency to run when the balance was removed. In this case the before-mentioned operations can be performed without first blocking the train.

The parts we have now removed—viz., the balance, hair-spring, and scape wheel—constitute what is known as the "escapement," which is by far the most delicate part of a watch. Great care should, therefore, be observed in handling it.

The rest of the watch, an inspection will show, is merely a train of wheels by which power is transmitted from a mainspring, in the first place, to the escapement. The escapement is, in fact, *the watch*; the rest is merely designed for the purpose of driving the escapement and recording its vibrations.

In a ¾-plate watch, the whole remaining wheel-work is contained between the two plates. In a bar watch, each wheel is held by its own particular bar. In either case, the removal of the screws of bars or plate will enable all the remaining wheels to be taken out. Before doing this, however, the centre spindle, or set-hand piece, as it is termed, must be taken out. This, it will be seen, has a steel pinion pushed tightly on to its under side. To remove this spindle, hold the movement in the hand, dial side up, and with the hammer give the projecting point (upon which the minute hand, the long one, was fixed) a smart tap. This will knock it through, and the steel pinion can be lifted off with the tweezers, and the centre arbor, or spindle, withdrawn from the back. It is also advisable, before removing the plate, to undo the small screws, and take off the brass or steel cap which surrounds the winding square and holds down the ratchet-wheel and clickwork. When this is off, the said ratchet and clickwork can be removed also.

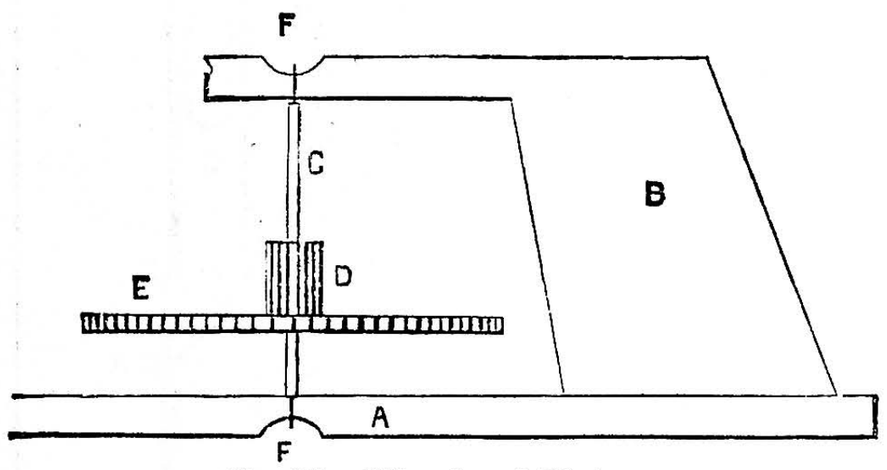

Fig. 13.—Wheel and Pinion.

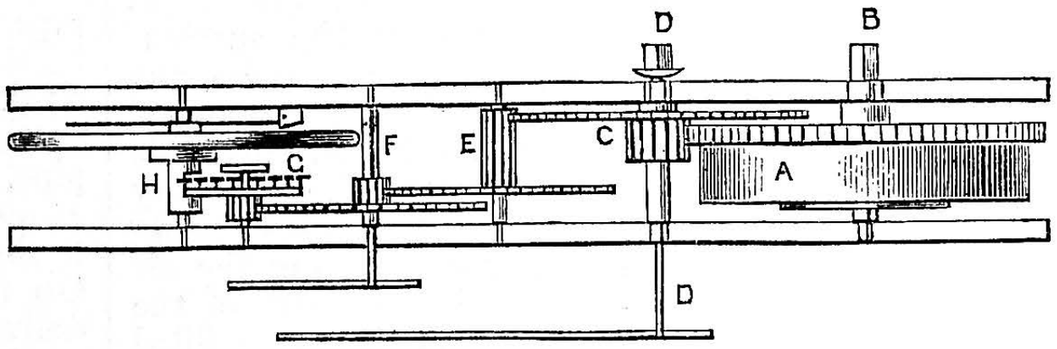

Fig. 14.—Arrangement of Wheel-work.

The watch will now lie on the paper in pieces, and the beginner will doubtless be surprised at the comparatively small number of wheels which it contains. We will now enumerate these, and describe their uses, and endeavour to give an insight into the working of the entire watch. A thorough appreciation of the use of each part will make the task of putting together correctly an easy one.

The watch, till we get to the escapement, may be summed up thus: mainspring, wheels, and pinions. Just here a little explanation of terms will not be out of place. Looking at Fig. 13, A is a "plate," B is a brass "cock" screwed to it, C is a spindle or, more correctly, "arbor," D is the "pinion" (a small steel wheel), E is the "wheel," F, F are the "pivots" upon which it runs in its "pivot-holes."

Thus the great wheel, or first wheel in a watch—the driving wheel, in fact—is formed hollow, like a box, and in a Geneva watch is called the "barrel." This contains the mainspring, designed so as to make the barrel perform four complete revolutions

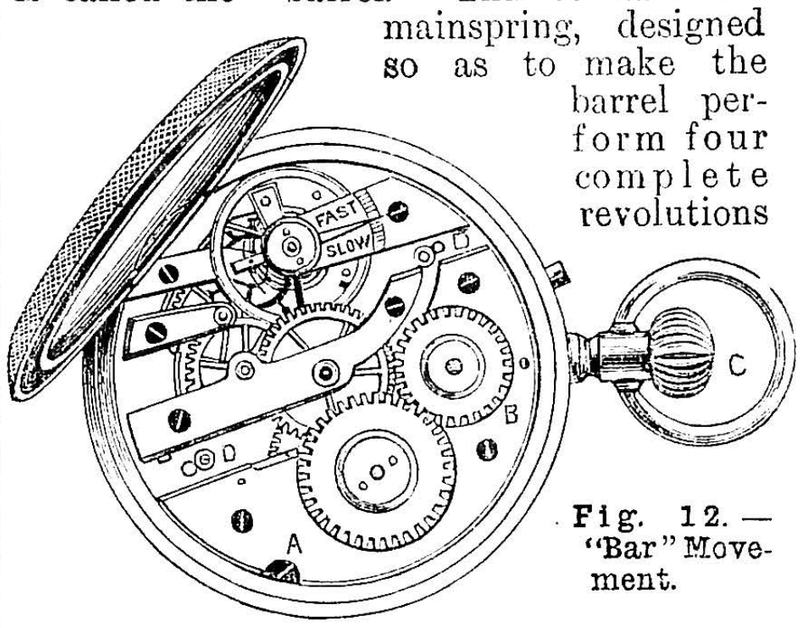

Fig. 12.—"Bar" Movement.

before its strength is spent. This wheel drives the *centre-wheel* pinion. The centre wheel makes thirty-two complete revolutions before the mainspring is spent. It revolves once in an hour, and its arbor (the set-hand piece referred to above) carries the minute hand, which therefore goes round once in an hour and marks minutes by divisions round the dial. This arbor, by means of the steel pinion (the *cannon pinion*) and the *motion wheels* under the dial, turns the hour hand, which marks hours. It is evident, therefore, that the watch if left alone will keep time for thirty-two hours, or eight hours more than should be required if it is wound regularly. This allows an ample margin for the somewhat irregular habits of some watch wearers.

Proceeding with the train, the centre wheel drives the *third wheel*, which in its turn drives the *fourth wheel*. This latter carries the seconds hand, if the watch has one, and revolves once in a minute—that is, it makes sixty revolutions to one of the centre wheel. In a ¾-plate watch this wheel is the last held in position by the plate, and in a bar watch is the last provided with a large brass cock to keep it in position.

The fourth wheel drives the *scape wheel* in such a manner that the latter makes one revolution in six seconds. The scape wheel, by means of its peculiar teeth, drives the *balance*, making the latter perform two single vibrations for each tooth which passes. The rapidity with which the balance vibrates is determined by the strength and length of the *hair-spring*. This hair-spring is so selected that it makes the balance perform five vibrations, or make five "ticks," per second. The precise action of the escapement will be explained later on.

In a watch, to bring all these parts into as small a space as possible, they are arranged between plates, etc., of a circular form, and are necessarily cramped somewhat; but if they were all arranged in line between two plates, escapement as well, they would present an appearance something

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like Fig. 14.—A, barrel, containing mainspring; B, barrel "arbor," or winding square; C, centre wheel and pinion; D, set-hand arbor, friction-tight in it, carrying minute hand; E, third wheel; F, fourth wheel, carrying seconds hand; G, scape wheel; H, cylinder, carrying balance, I. This figure will render the description more clear.

RAM OR PLUNGER-PUMPS.

BY PHILIP R. BJÖRLING.

HISTORY — CLASSIFICATION — SINGLE-ACTING PLUNGER-PUMPS AND HOLLOW RAM-PUMPS.

THE practical cause of failure of the solid, single-acting piston pump was its liability to jamb in the working-barrel by sand and gravel, and leakage of its leathers was apt to cause serious accidents to the costly pump-rods, and even to the steam engine.

Plunger-poles fitted to the case—the latter having longitudinal grooves for the passage of the water—were used at an early date in France. One of these pumps is described and illustrated in the "Dictionary of Mechanical Science," by Alexander Jamieson, LL.D., published in the year 1827. It is illustrated in Fig. 1, and consists of a wooden trunk, square or round, open at both ends, and having a valve at the bottom. N O is the surface of the water in the pit or well, and K the place of delivery. The pit must be as deep in water as from K to N O. A B C D is a wooden trunk, open at both ends, and having a valve, P, at the bottom. The top of this trunk must be in a level with K, and has a small cistern, E F. It also communicates laterally with a rising pipe, G J, furnished with a valve, H, opening upwards. M is a beam of timber, so fitted to the trunk as to fit it without sticking, and is of at least equal length. It is suspended by a chain from a working beam, and loaded on the top with weights exceeding that of the column of displaced water.

Sir Samuel Morland, Master of Mechanics to King Charles II., in the year 1674 invented and patented the plunger-pump made of cast iron. One of the most important features in plunger-pumps and dry-spear-pumps, as also in the steam engine, is the *gland* and *stuffing-box*, which was undoubtedly invented by Sir Samuel Morland, although it has been erroneously attributed to James Watt by some writers.

The arrangement used before the invention of the *gland* and *stuffing-box* was described in the following manner in the "English Encyclopædia," published in 1802:—

"The forcing-pump is sometimes of a very different form from that already described. Instead of a piston, which applies itself to the inside of the barrel, and slides up and down in it, there is a long cylinder, nicely turned and polished on the outside, and of a diameter less than the inside of the barrel. This cylinder is called a working barrel, and is constructed as follows:—The top of the barrel terminates in a flange, pierced with four holes for receiving screw-bolts. There are two rings of metal of the same diameter, and having holes corresponding to those in the flange; four rings of soft leather, of the same size and similarly pierced with holes, are well soaked in a mixture of oil, tallow, and a little resin. Two of these leather rings are laid on the pump flange, and one of the metal rings above them. The plunger is then thrust down through them, by which it turns their inner edges downwards. The other two rings are then slipped on at the top of the plunger, and the second metal ring is put over them, and then the whole is slid down to the metal ring. By this means the inner edges of the last leather rings are turned upwards. The three metal rings are now forced together by the screwed bolts, and thus the leather rings are strongly compressed between them, and made to grasp the plunger so closely that no pressure can force the water between them. The upper ring just allows the plunger to pass through it, but without any play, so that the turned-up edges of the leather rings do not come up between the plunger and the upper metal ring, but are lodged in a little conical taper, which is given to the inner edge of the upper plate, its hole being wider below than above. It is on this trifling circumstance that the great tightness of the collar depends. To prevent the leathers from shrinking by drought, there is usually a little cistern formed round the head of the pumps, and

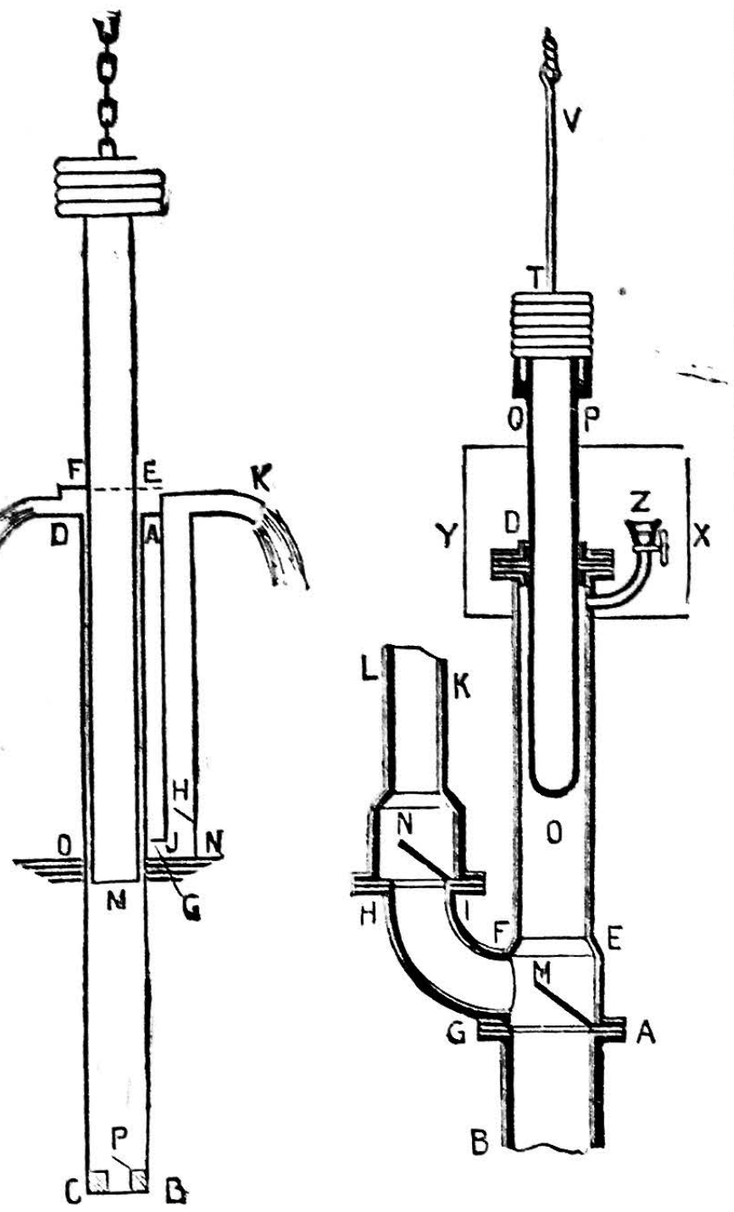

Fig. 1. Fig. 2.

Ram or Plunger-Pumps. Fig. 1.—Ancient Ram-Pump. Fig. 2.—Ram-Pump with Delivery Clack on the Side of the bottom of Working Barrel.

kept full of water. The plunger is either forced by a rod from a working beam or by a set of metal weights laid on it."

This pump is illustrated in Fig. 2, in which A B is the top part of the suction-pipe; D E F is the plunger-case; O P Q, the plunger or plunger-pole; V, the plunger-rod; T, the weights; M, the suction-clack; N, the delivery-clack; H I, the delivery clack-piece; K L, the delivery-pipe, or rising main; Z is a cock for discharging the air which accumulates in the top part of the plunger-case; and X Y is a cistern filled with water to prevent the packing leathers from getting dry.

CLASSIFICATION.

The writer will now proceed to describe each separate type of plunger-pump, dividing them into the following classes:—

1. Single-acting plunger-pumps.
2. Single-acting hollow ram or plunger-pumps.
3. Double-acting plunger-pumps.
4. Bucket and plunger-pumps.
5. Piston and plunger-pumps.
6. Plunger and plunger-pumps.

1. SINGLE-ACTING PLUNGER-PUMPS.

Those which have the suction-valve in a line with the plunger, and the delivery-valve on the side at the bottom of the plunger-case.—A pump of this type is illustrated in Fig. 2, and has already been described.

Those which have the suction-valve in a line with the plunger, and the delivery-valve on the side at the top of the plunger-case.—This class of plunger-pump was invented—or, perhaps more correctly, designed—by the great Richard Trevithick, in the year 1797. It is illustrated in Figs. 3 and 4. The plunger-pole was made of cast iron, turned on the outside, and working in a cast-iron plunger-case or working-barrel, the sides of which were not touched by the pole. The pole-case was provided with a stuffing-box and gland and the necessary valves. Trevithick's pumping gear was quickly appreciated, and during the succeeding four or five years many of the principal mines in Cornwall had their old bucket-lifts removed to make room for the new plunger-sets. This form of pump is still largely used—almost as he designed it in 1797. Fig. 3 is a longitudinal section, and Fig. 4 a sectional plan. A is the plunger-rod of wood, fastened into the hollow cast-iron pole or plunger, B; C, the pole-case, allowing space for the passage of water round the pole; D is the stuffing-box; E, the bottom or suction-valve, allowing the water to ascend into the pole-case on the ascent of the plunger; F, the top or delivery-valve, through which the water is forced upward, through the pump-trees or rising main, on the descent of the plunger.

The plunger-set, made useful in the Cornish mines by Trevithick, met all the requirements: raising the water by the descending pump-rods, having greater simplicity of structure and freedom from breakage and liability of jambing.

Those which have the clack-pieces on the side of the plunger-case, so that the wind-bore, suction-clack, delivery-clack, and rising-main are all in one line.—An illustration of this pump is given in sectional elevation, Fig. 5. This arrangement is mostly used at the present day for convenience of fixing same in the shaft or well, and easy access to the valves. It consists of the plunger-case, A; the stuffing-box and gland, B, bolted to the top of the plunger-case; C is the plunger-pole, consisting of a cast-iron tube, turned on the outside, and forced on to a wooden spear. The plunger-case, A, is secured to the top of an H-piece, consisting of a short pipe, J, and the suction clack-piece, K, united by the water-way, or throat, L. The suction clack-piece is bored at E to receive the suction-clack; H is the wind-bore, or suction-pipe, bolted to the underneath flange of the H-piece; and the pipe, J, is secured to timber built into the sides of the shaft. On the top of the H-piece is secured the delivery clack-piece, which is bored at F to receive the delivery-clack. G is the pump-trees, so called because originally they were made from logs of trees, bored out and strengthened by wrought-iron hoops.

2. SINGLE-ACTING HOLLOW PLUNGER-PUMPS.

A pump of this description is illustrated in Figs. 6, 7, and 8. Fig. 6 is a sectional elevation; Fig. 7 gives a view of the top of the plunger; and Fig. 8 shows the plan of the delivery-valve.

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The plunger-case is similar to the ordinary one, and is fitted at the top with a stuffing-box and gland. To the top of the stuffing-box is secured a delivery clack-piece, furnished with a door for access to the delivery-clack; and to the top of this clack-piece is bolted a cover, provided with a gland and stuffing-box, for the pump-rod (not shown in the illustration). The plunger consists of a hollow pipe, A, without flanges, turned all over perfectly true and parallel; or, at least, it ought to be so. It is furnished at top and bottom in the inside with two lugs, B, through which pass two wrought-iron rods, C, provided at the bottom ends with double nuts, and at top secured to a cross-piece, D, forged on the main pump-rod, E, and secured by double nuts. The delivery-valve, F, in this example of hollow ram or plunger-pump, is simply a round disc sliding on the two rods, C, the disc being faced with leather; and a cross-piece, G, secured to the plunger-rods, C, by colters, is provided for determining the lift of the valve.

DETECTIVE, HAND, AND MAGAZINE CAMERAS IN TROPICAL COUNTRIES.

BY J. C. HANNYNGTON.

THE variety of the above-named class of cameras, with which the market is now stocked, is so great as to cause selection to be difficult. I have, therefore, put together a few observations which may assist an intending user in deciding what kind of camera he will buy or make.

I will deal first with the exposing shutter with which all cameras of this class are provided. All are made to give very rapid and also time exposures.

If the shutter, when set for a time exposure, flies up with a jerk, remains open for such time as an elastic ball or a button be held pressed, and flies back with a jerk when the pressure is released, it will almost invariably shake the camera more or less, and the effect of the shake will be distinctly noticeable when a short exposure of less than two seconds is given. It is well, therefore, to have the power of exposing by hand—that is to say, by capping and uncapping the lens or aperture through which the lens looks.

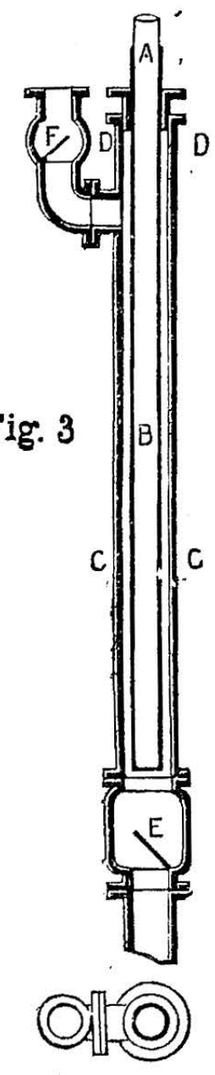

Fig. 3

Fig. 4

Ram or Plunger Pumps. Fig. 3. — Trevithick Ram Pump. Fig. 4. — Sectional Plan.

If the exposure has to be made by pressing a button or pulling a string, the action is very likely to cause shaking, whether the exposure be long or short, and whether the camera is held in the hand or attached to a stand. An exposure actuated by a pneumatic ball and tube is therefore preferable.

A hand camera may be of any size and any shape which it is possible for the operator to lift, point at the object, and fire off a shutter whilst so pointed, but it is likely to be an inconvenient companion of larger than half-plate size.

Any small camera with good light-tight slides or backs and a quick shutter will do as a hand camera. Some people like to have a finder, which can be easily attached; many prefer to work without any finder. I consider the finder exceedingly useful. Hand cameras may be divided into two classes—automatic and manual, both these classes including magazines. In the automatic class, a button or something is pulled or pushed, and a fresh plate from the magazine or reserve takes the place of the plate last exposed. In the manual class the plates may be carried in backs and inserted or fitted to the camera in the usual way, or the exposed plate may be raised by a lever grasped by the hand and placed at the back of the reserve of plates, or the back plate of the reserve may be raised and placed in front of the last exposed plate.

This latter plan is that adopted in Rouch's "Eureka," which has the following defects. Unless the magazine is fully charged with the dozen plates or dummies, it will not work at all; and if you want to expose only two plates you

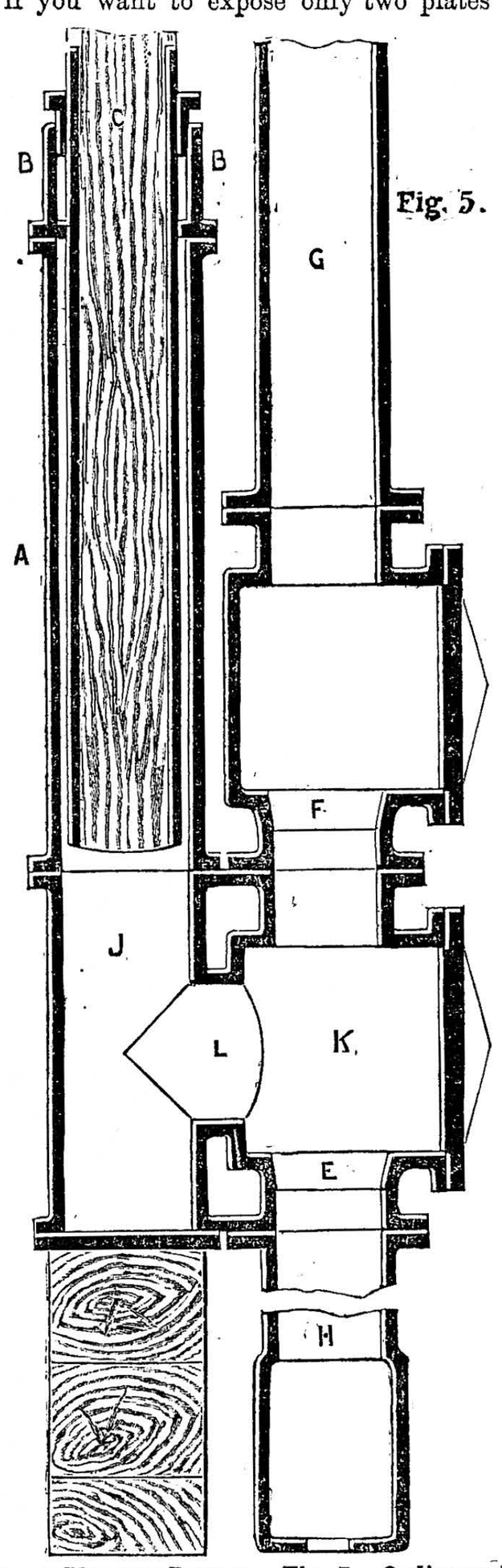

Fig. 5.

Ram or Plunger Pumps. Fig. 5.—Ordinary Ram Pump.

must carry the weight of ten extra ones, for if even one sheath is empty the apparatus will not work. Again, if you have twelve sensitive plates in the magazine, and having exposed only one, wish to develop it at once, you must remove eleven plates to get at the one you want.

In another camera of this form this last defect does not exist, as it is the exposed plate which is removed and placed in rear of the unexposed lot.

In all cameras of this class, as well as in most of the automatic class, the plates are held in metal sheaths, and these sheaths, whether of zinc or iron, are liable to rust or oxidise, and the oxide comes off and makes spots on the plates. Varnishing the sheaths is fatal, but the metal sheaths may be dipped in boiling paraffin wax, the surplus wax rubbed off, and this will to a great extent prevent the evil.

A convenient kind of hand camera which may be made by the amateur (with the exception of the carriers or dark slides) is a box camera with an ever-set shutter (such as the automatique) fixed inside, opposite the hole of the lens mount. The lens should screw on outside, as in any ordinary camera, and should have a rack and pinion or a draw tube for focussing, for the camera being a mere box, no focussing can be done with it. The length of the camera should be arranged so that when the lens is racked or pushed right home the plate shall be in focus for distant objects; and for nearer objects the lens can be extended, the focussing being done on a focussing screen as usual, or preferably by marks on the lens tube previously arranged for various distances. The plates are carried in dark backs which slide or clamp into position. A leather handle on the top of the box facilitates carriage, and a screw-hole should be placed in the bottom and side of the box for use when it is desired to use a stand. The camera, if cunningly made, will carry a couple of extra dark backs inside, and can be fitted with finders inside or out. I consider this camera preferable to the kind in which an ordinary bellows camera is contained in a box with a hole in front for the lens to look out.

The best kind of dark back for a camera such as I have described is that in which the shutter of the back draws entirely out. Chadwick makes a very superior camera of this class. It has, however, a bellows body, and has to be "set up" each time it is required for use, so that it is not so constantly ready as the box I have described, but it has many qualities which render it superior to the box. It will take stereo pictures on a half-plate or on two quarter-plates, and it will take pictures the full size of the half-plate, and is, besides, a thoroughly good working camera for all sorts of work. The box form is superior only in solidity, simplicity, cheapness, and ever-readiness. Again, any camera may be fitted with a roll holder to carry a roll of sensitive film. No magazine camera yet devised can compare in convenience with this method, as the exposures can be made one after another with considerable rapidity, and the use of the film reduces the weight to a minimum.

Of this form of camera I have seen none to excel the Kodak. Of the automatic class I know of none better than the Ideal. Of the manual class I like Chadwick's and a magazine camera made by Stipn on the principle of the Eureka. The following are the points:—

Is the arrangement for changing plates (whether automatic or manual) simple and certain in action?

Are there means of altering the focus?

Are there means to alter the aperture of lens?

Can the camera be used for ordinary work, such as enlarging, reducing, etc.?

Can the apparatus be carried about without inconvenience and constantly ready for immediate use?

Is the instantaneous shutter of a type which is ever set ready for action, which will not shake the camera in discharge, and which will admit of time exposures being given without shake?

Can the lens be easily removed for cleaning?

Is the instantaneous shutter totally devoid of indiarubber blinds or bands which will not stand a tropical climate?—*Journal of the Photographic Society of India.*

Fig. 6.

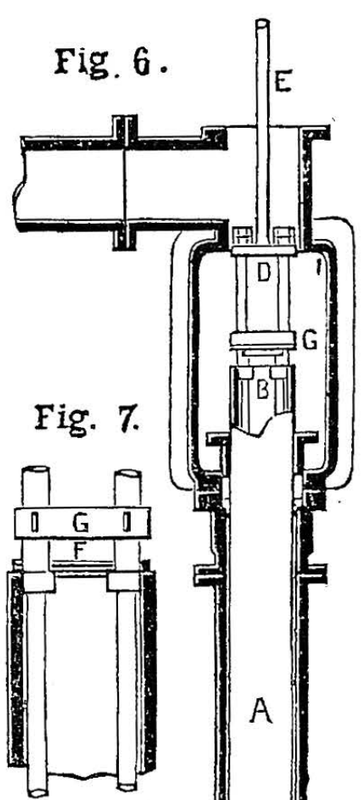

Fig. 7.

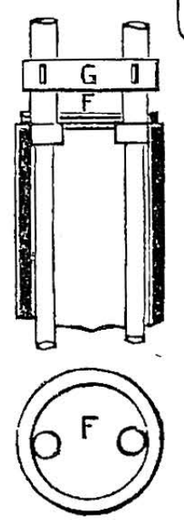

Fig. 8.

Ram or Plunger Pumps. Fig. 6.—Hollow Ram Pump. Fig. 7.—Top of Plunger. Fig. 8.—Plan of Delivery Valve.

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NEW UNIONISM.—Some of the Derbyshire miners are beginning to find out certain disadvantages in the working of a rigid five days' week, and have applied to their council to be permitted to work also on Saturdays on certain occasions. This permission has been refused, and the council passed a resolution to the effect that Saturday must not be worked until the Miners' Federation gave permission. It is curious that the reduction of the working week to five days has not materially reduced the output of coal, so that the adoption of this curtailment of labour has not been attended with friction. The fact of the matter, however, is this: the miner is naturally fond of enjoyment when he is above ground, and delights in attending "feasts," races, and other sporting meetings. These cannot be enjoyed without having money to spend, hence he is anxious to be permitted to earn some extra money in the summer season. Should the agitation for compulsory shortening of the general hours of labour be in any measure successful, more of this class of complaint may be looked for, but even this one should have some effect on the minds of the workmen who think.

EDUCATION AND INVENTION.—If we run through the history of inventions, it is very notable that scarcely any important ones have come through educated men, and, great as is the advantage of a liberal education to the average man, it must be observed that it is in many respects inimical to originality. If an individual is taught how to compass all the ends he may desire to attain, he will, as a rule, be content to keep in the groove into which he has fallen, and although he may make some of those small alterations in machinery or methods which in our day are dignified by the title of invention, he does not strike out new and original ideas, as did the celebrated inventors of the first half of the present century. The very routine of laborious learning clogs the imagination, and restricts it to an arbitrary channel. Under the present high-pressure system of teaching, the object of learning is too often lost sight of in the anxiety to pass certain examinations. The student tells you he or she, as the case may be, is working up for such or such an examination; that examination past, the course of study is turned in another direction to meet the requirements of some other examination, and thus the memory is temporarily crowded with an amount of information which is very seldom retained, because it is, in the first place, too hurriedly acquired and subsequently neglected, and thus the legitimate end of education is defeated, while a severe course of over-study at the same time wearies and wastes the brain, and leaves it without the vigour essential to originality. Intervals of rest and relaxation, sufficient to allow of the mental digestion of facts and theories and their critical consideration, are absolutely necessary if we wish to progress as a nation. We wish those who are responsible for, at least, the elementary education results in this country would turn their attention to a "thinking" system of instruction, instead of the "parrot" and sing-song method adopted by the Board Schools.

EMPLOYMENT OF DISCHARGED SOLDIERS.—The War Office is at last making an effort in the right direction to facilitate the employment of time-expired men of the Army Reserve, which is recruited from the ranks of the discharged men of the regular army. By arrangements with other public departments, the Army Reserve men are to have the preference over other candidates for suitable situations. The War Office itself employs 1,600, and in the Metropolitan and City Police there are engaged upwards of 2,000 men. In the Post Office only some 1,500 are at present employed, but it is to be hoped that this number may ultimately be increased to 25,000 as the different posts fall vacant. The number of Army Reserve men thus employed by no means exhausts the ranks of those anxious to find situations, and it was in the hope of exciting favourable interest on behalf of those still unemployed that the heads of the War Office recently conferred with the managers of all the leading railway companies. While the managers expressed themselves in sympathy with the project, they pointed out that there were other claims to be met from the sons of old employés. The movement which has been so successfully started by the Government for dealing out something like justice to the Army Reserve men may not solve the great recruiting question, which at the present time more than usually troubles the army authorities; but the knowledge which will speedily gain ground that the time-expired man is not simply granted his pension and left unassisted to fight his way for work must inevitably make its influence felt. The great hiatus, however, is this: the men have been taught little else but to shoot down fellow-creatures. If the army scheme permitted some useful and profitable technical teaching and training for soldiers during peace time it might be possible for the soldier to turn to some useful and specific work in the labour market when his period of short service had expired. Why should there not be technical classes for soldiers? We have received and shall print correspondence which has reached us *à propos* of our leaderette in No. 178. The discharged soldier is heavily handicapped in the labour market, and some methods should be forthcoming to remedy this.

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CHEMICAL APPARATUS: HOW TO MAKE AND USE IT.

BY H. B. STOCKS.

INTRODUCTORY — METHOD OF WORKING GLASS TUBES—MATERIALS REQUIRED AND PRICE—BENDING TUBES: PRECAUTIONS NECESSARY—OXYGEN APPARATUS: HOW TO MAKE—HYDROGEN APPARATUS: HOW TO MAKE—THISTLE FUNNEL — PRECAUTIONS NECESSARY IN THE PREPARATION OF HYDROGEN — PNEUMATIC TROUGH AND GAS JARS—METHOD OF COLLECTING GASES OVER WATER.

SINCE the time of Faraday very little has been done towards teaching students of chemistry how to manufacture their own apparatus. In the "Chemical Manipulation," written by Faraday, is given a great deal of information upon this point, and also how to successfully conduct experiments. More recent text-books generally take it for granted that the student has already learnt to fit up his own apparatus, or that he buys them ready fitted up. Now, this knowledge is hardly possible in the case of those who are not attending any class, or even in the case of a large proportion of those who are attending classes. I find they are very deficient in this particular. It is to such students as I have mentioned that I address the following notes, arising out of practical work in chemical laboratories, and which I hope may be followed by the very beginner himself.

Do not get the notion that a student may manufacture everything he requires from the raw materials; flasks, beakers, and such-like apparatus must be bought, as we have not sufficient skill, or the appliances, and nicely regulated heat used in the glass-house, to make them. I will point out as I go along what it will be necessary to buy, and the price. The advantage to be gained in fitting up the apparatus will be twofold—a saving of money, and a gain of experience in the deft fingering required in handling thin glass apparatus, and therefore a consequent decrease in the number of breakages.

I propose, then, at the outset to describe the method of working small glass tubes, as a number of useful exercises will thus have been performed. The materials required for this purpose are 1 lb. of glass tube, $\frac{3}{8}$ in. internal diameter, costing 1s.; triangular file, costing 4d.; the Bunsen burner, described at p. 167, or the blowpipe (p. 250); one length of thin glass tube, $\frac{1}{2}$ in. internal diameter, costing about 4d.; one piece of stout glass rod, costing about 2d.; and a piece of hard charcoal.

For the purpose of bending small tubes it is most convenient and satisfactory to use the flame of an ordinary gas jet. Fig. 1 may be taken as an example. Cut off a portion of the small glass tube, 20 in. long, in the following manner:—Make a scratch with the file at the place where it is required to break the tube, take the tube in both hands, hold the thumbs close one upon each side of the file-mark, and give a slight jerk. If the tube does not break, increase the file-mark until the object is effected.

Turn down the gas until you have a flame about $1\frac{1}{2}$ in. wide, hold the tube on each side of the flame at the tip of the bright portion (Fig. 2), turning it round all the time, so that it may be equally heated. When the glass commences to soften, apply a very gentle movement in one direction, so as to produce a curve like that at Fig. 1, A, and not as at Fig. 1, B, which is badly made and very liable to crack. During the heating up the tube will have become coated with a deposit of soot. Do not remove this: as it is a bad conductor of heat, it will allow the glass to cool down slowly. Place the tube resting against a block of wood, so that the bend may not come in contact with any cold surface. When cold, proceed to bend up the other end slightly. The end being heated in the flame, you will not be able to take hold of it. When the glass is soft enough, give it a touch with the piece of charcoal, which will bring it into the required position, allow to cool again, wipe off the soot, and proceed to round off the rough ends of the tube. For this purpose hold each end in the hot air issuing from the Bunsen burner (Fig. 3), and gradually bring it down into the hottest part of the flame. The ends will then fuse slightly, and be rendered stronger, neater, and much less liable to crack. Cool down each end by blackening it in the smoky flame produced by cutting off the air supply.

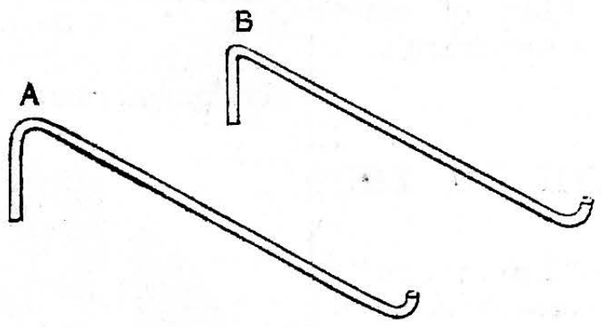

Fig. 1

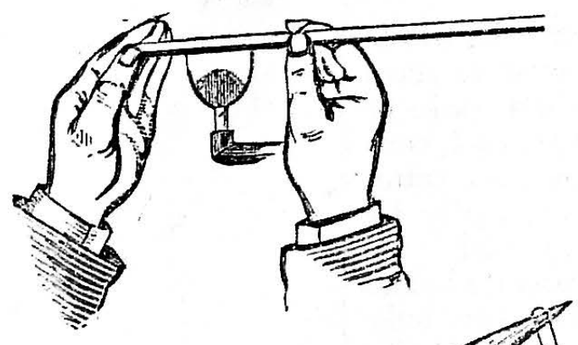

Fig. 2

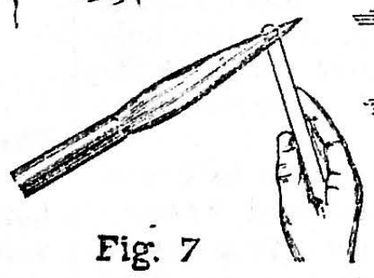

Fig. 7

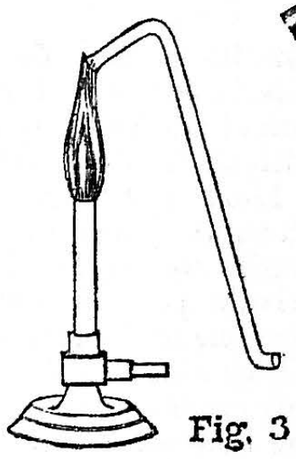

Fig. 3

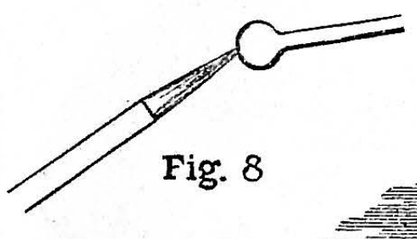

Fig. 8

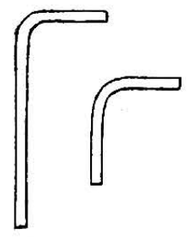

Fig. 5

Fig. 6

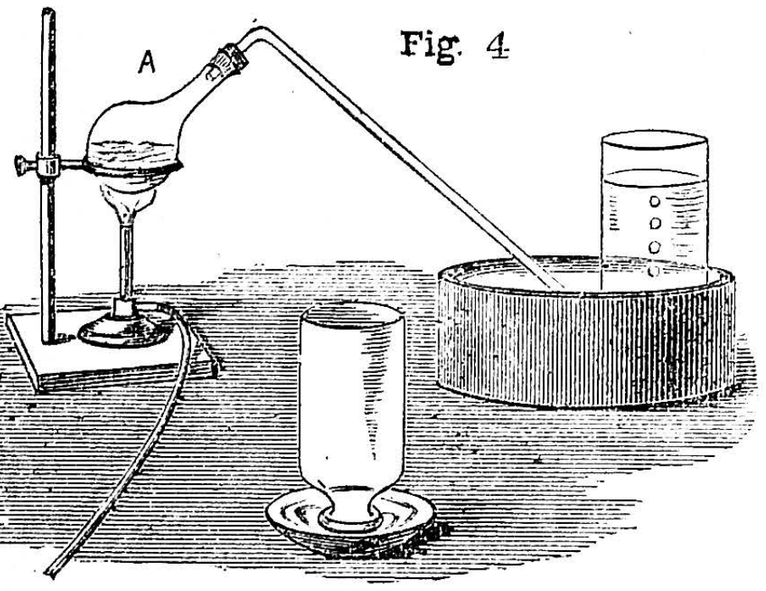

Fig. 4

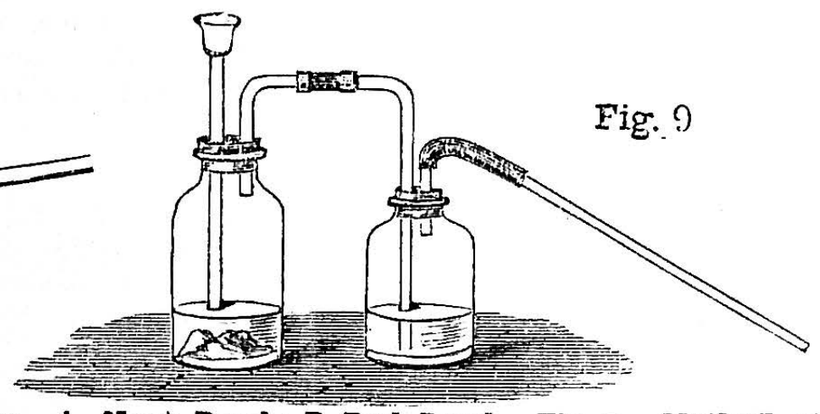

Fig. 9

Chemical Apparatus. Fig. 1.—Bent Tubes—A, Neat Bend; B, Bad Bend. Fig. 2.—Method of bending Glass Tubes. Fig. 3.—Rounding Ends of Glass Tube. Fig. 4.—Apparatus for preparation of Oxygen. Fig. 5.—Bent Tubes for Hydrogen Apparatus. Fig. 6.—Thistle Funnel. Figs. 7 and 8.—Method of making Thistle Funnel. Fig. 9.—Hydrogen Apparatus.

A great necessity in heating glass is to increase the heat very slowly, and to cool the object down very gradually; otherwise, fracture is almost sure to ensue. Thin glass does not require such great precaution as thick glass, owing to the heat penetrating better and more equally in the former.

Having bent one tube satisfactorily—mind, I do not say you will be able to do this the first time, but by practice and patience you will be able to bend any tubes required—the rest will be easy.

The tube which I have given as an example is a portion of the apparatus shown at Fig. 4, which is used for the preparation of oxygen or of nitrous oxide (for which see text-books). It consists of a hard glass flask, A (a Florence oil flask will do if it can be procured), costing about 4d., and the tube you have made. The flask is supported upon a retort stand, or other support, to be hereafter described, and is heated by means of a Bunsen burner.

To fit up this apparatus, get a sound cork, fitting tight in the flask, wrap it in a piece of paper, and roll it under the ball of the foot—this will render the cork very pliable—then, by means of cork-borer (three sizes cost 1s.) or red-hot iron rod, bore a hole into which the tube fits very tightly. If by the above means a hole cannot be made as large as required, it may be enlarged by means of a coarse rat-tail file (cost, 6d.), which will be found a useful adjunct. Having made the hole, push the glass tube through until it just projects on the other side of the cork.

That the work of the student may be continuous, and not of a disjointed nature, I propose at this point to show in what way the oxygen may be collected.

Our apparatus for this purpose may be very simple and inexpensive. Any gas (such as oxygen) that is not appreciably soluble in water may be collected over water. The apparatus used is called a pneumatic trough, for which any flat-bottomed bowl or tin basin will do. The jars for collecting the gas may be ordinary wide-mouth pickle jars, which do excellently. To collect the gas, place a jar in the bowl, which should be full of water, and fill the jar perfectly full of water, then slide upon the mouth a ground glass plate which has been slightly greased, invert the jar, and withdraw the plate, keeping the mouth of the jar under the water. The jar will then remain full of water. Bring the exit tube of the apparatus under the mouth of the jar, and the gas, as it issues, will displace the water. When the jar is nearly full of gas, slide a saucer under the mouth of it,

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and withdraw the jar and saucer. The jar may then stand in the saucer of water until you have collected as many bottles of the gas as you require.

When you are preparing a gas requiring heat, as each jar is filled, lift the exit tube out of the water before taking away the source of heat; otherwise, as the flask cools water will ascend the tube, fall into the hot flask, and crack it.

We may now proceed to bend the tubes shown at Fig. 5. Cut one piece of tube 6 in. long, and two pieces 4 in. long, and bend each as shown, one piece having a longer limb than the other two. Having finished these off as already pointed out, proceed to make what is called a "thistle funnel" (Fig. 6). Cut off a piece of tube, 12 in. or 13 in. long (see that the glass is pretty thick), hold one end of it in the flame of the Bunsen burner, or blowpipe, in the position shown (Fig. 7), so that the glass, as it becomes pasty, may not fall from the tube. When the tube has melted up, and there is a knob of pasty glass on the end, remove it quickly from the flame, and, holding it vertical, blow into the open end, turning the tube round all the time, so as to blow a large bulb upon it which is as nearly spherical as you can get it. If you do not succeed the first time, melt it up again, and again blow out; but take care not to blow too hard, otherwise, your bulb will burst. If you have been successful, and your bulb is a fairly strong one, turn down the flame of the blowpipe very low, and commence blowing. Bring your tube with the bulb directly on to the point of the flame in the direction shown at Fig. 8. The bulb will quickly fuse at this point. Blow suddenly, and with force. The end will be blown out into a wonderfully thin balloon of glass, which will burst with a loud report. Crumble away all the fine glass from the bulb, and hold it in the Bunsen flame, turning it round quickly, so that only the edge is fused.

We may now fit up the hydrogen apparatus (Fig. 9). Procure a 4 oz. and a 2 oz. wide-mouth bottle, and corks to fit. Having bored two holes in each cork, place the thistle funnel and one short tube in the cork for the large bottle, and the other tubes in the cork for the small bottle. Allow the funnel to come nearly to the bottom of the bottle, and the same with the longer tube in the small bottle. Connect the bottles, as shown, by means of a small piece of indiarubber tube (4d. per foot), and the second bottle to a long piece of glass tube reaching to the pneumatic trough.

To prepare hydrogen, place your zinc in small pieces in the first flask, pour water through the funnel until the bottle is about a quarter full and the end of the funnel is covered, pour a little water into the second bottle sufficient to cover the end of the longer tube, cork it up, add a little acid through the thistle funnel. Gas will immediately begin to come off, and will be washed by passing through the water in the second bottle, finally escaping by the long tube to the gas jars in the pneumatic trough.

A word or two of caution is necessary in the preparation of hydrogen. Allow the gas to pass away a minute or two before collecting any, otherwise the air in the apparatus makes a very explosive mixture with the hydrogen. Two explosions due to this cause I have already seen. It is best to collect a small test-tube full, and apply a light to the mouth of the tube. If it burns quietly, you may collect, but if it makes a sharp crack, let a little more gas pass away before collecting.

Do not perform your experiments on the drawing-room table, as sulphuric acid has a powerful affinity for almost anything. A common bench, or a kitchen table, over which spread a piece of American cloth, is best; and note that drops of sulphuric acid rapidly eat a hole through clothes, carpets, etc. The best antidote is to sponge the cloth immediately with ammonia, which neutralises the corrosive effect. I should advise also that all chemicals be locked up to prevent accidents and mistakes, which are already rather frequent.

In my next article I propose to give another lesson in the working of glass tubes and fitting up of glass apparatus.

THE CYCLE: ITS WORTH TO THE NATION.

Being the Second Prize Essay by "ENDEAVOUR" (ALEXANDER STEPHENSON), 3, *Dixon Road, Swan Hill, Glasgow.*

IN trying to estimate the worth of the cycle to the nation, one must take into consideration the fact that the cycle, whether considered as an article of commerce or an article of use, is comparatively a new thing.

Considered as a mechanical machine, its life is so young that it cannot yet be expected to have reached perfection, or even the highest state of improvement of which it is capable; and, considered as an article of use, its uses are being discovered and utilised every day, especially by public bodies, such as the military and civic authorities, as well as by numerous private bodies for business purposes. We can, therefore, only estimate approximately its *present* worth to the nation, and in doing so will endeavour shortly to note, first of all, what the cycle is.

The word "cycle" is used by us to denote every form of velocipede. The word "cycle," a circle, strictly means one wheel, thus—cycle, one wheel; bicycle, two wheels; tricycle, three wheels; quadricycle, four wheels; and so on. The

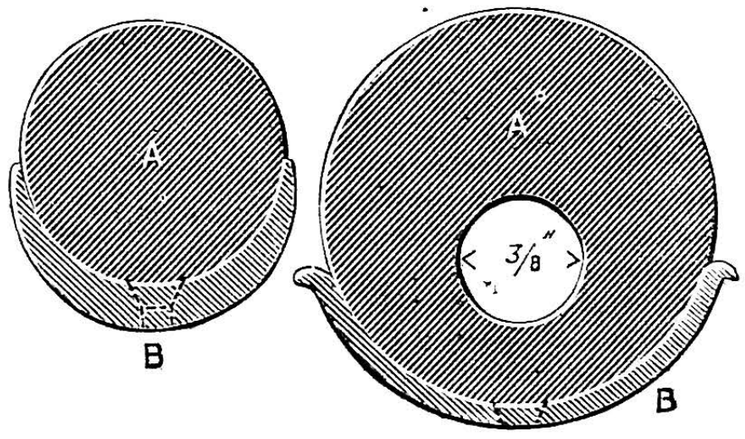

Fig. 1 Fig. 2

The Cycle. Fig. 1.—$\frac{3}{4}$ in. Solid Tire. Fig. 2.—$2\frac{1}{4}$ in. Cushion Tire.

word cycle, however, from usage, denotes very well every kind of machine, being a general term for all.

The cycle now so familiar to us, and that which is capable of being put to so many uses, is known as the Safety bicycle—the element of safety being but a comparative one, as it can only be said to be safer than any form of bicycle yet introduced.

In the beginning of the present century—1800 to 1820—a machine was introduced and used about the parks of London called the "Dandy-horse"; it had two equal wooden wheels about 30 in. diameter, the rider sat on a saddle placed on the centre of a horizontal backbone, and steered the front wheel with a cross handle-bar, exactly as in our Safety. The rider, when seated, could rest both feet on the ground, and the method of propulsion was by thrusting the toes into the ground backwards, thus giving forward motion to the machine and its rider. This must have been a fatiguing operation, and could only exist for a time as a novelty—since, indeed, it never reached any stage of usefulness.

The idea of two wheels running in line was indeed a novelty; but while the feet could reach the ground on either side anyone could perceive little difficulty in keeping the machine upright; but, when inventive genius conceived the idea of keeping the feet entirely clear of the ground, and propelling the machine by means of cranks on the axle, then the thing appeared to many minds an impossibility; for a man to balance himself on two wheels running in line seemed contrary to the law of equilibrium; yet it was only carrying out that law, as anyone may see by starting a wheel or hoop down-hill: the hoop will keep running upright so long as the conditions of the track are such as not to disturb the momentum.

In 1859 or 1860, the cycle known as the "Bone-shaker" was introduced as an article of trade, although I cannot find any patent in Philips' abridgments earlier than 1868. The Bone-shaker,

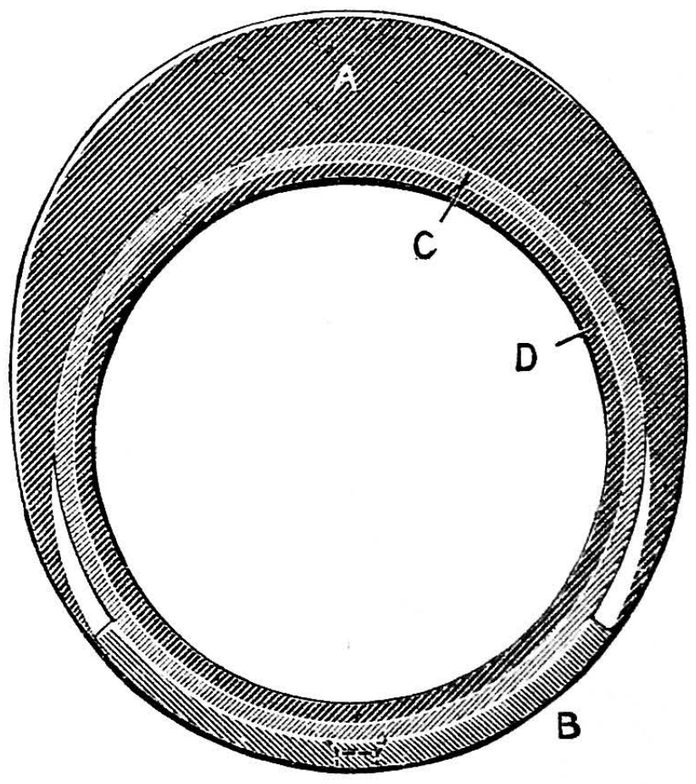

Fig. 3

The Cycle. Fig. 3.—2 in. Dunlop Pneumatic Tire.

like its parent, the Dandy-horse, had wooden wheels shod with iron, and was only the adaptation of cranks to the front wheel of that machine, with slight alteration of the frame.

Long prior to that date, however, many attempts (some of them successful) to apply cranks to the Dandy-horse had been made by private persons. The writer saw, in 1856, a machine made and ridden by a young man at Kilwinning, in Ayrshire. The front wheel of this machine was both driver and steerer, as in the Bone-shaker invented later on. Twenty years before this time—or about 1836—a blacksmith named McMillan, in Dumfriesshire, applied cranks to the rear-wheel of a Dandy-horse, thus constituting a rear-driving Safety. He became an expert in the use of this machine, and could ride it down-hill standing on the saddle; he made long trips on it—some of them to Glasgow, where on one occasion the crowd was so dense around him that, having run down a child, he was taken before the magistrates.

Coventry is understood to be the home of the Bone-shaker as put upon the market. The machine held its own till a better was introduced by the Coventry makers. Now began the period of tension spokes and rubber tires, and with their advent the Bone-shaker became dead stock. The general form of the machine now changed entirely; the front wheel grew larger, while the rear became proportionally small. A 6 ft. man got mounted on a 5 ft. wheel, and the element of danger was greatly increased, yet a speed of over twenty miles has been done on the Ordinary.

For about ten years the Ordinary was the popular machine, and in its best examples is a beautiful piece of mechanism. The danger of headers from being seated vertically over the pedals on the high machine was at once apparent. Many, and some fatal, accidents occurred; and makers sought to introduce a safer machine

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Greater safety was claimed for the "Facile," "Xtraordinary," "Sun and Planet," and some others, including several types of the "Kangaroo" pattern: all to give place in a great measure to the rear-driven Safety as we now have it, and to which we will now confine our remarks.

The Safety, now so popular, was introduced about ten years ago: the "Pioneer," "Rover," and "Bicyclette" being among the first types of what is certainly the safest and handiest cycle yet known to us. Since its introduction the production has more than quadrupled the output of the best days of any former type, and many thousands of persons are now using the Safety who never would have ventured on an Ordinary; and for every one maker of the Ordinary there are now perhaps fifty makers of the Safety

The Safety of to-day resembles more nearly the original Dandy-horse or Bone-shaker than any type introduced in the interim, in having two small equal wheels; it steers in the same way; the essential difference is in the rear-driving wheel. Of course, there is a vast improvement in material, general detail, and in the mechanism itself. All movable parts are fitted with steel balls in the bearings, thus reducing friction to a minimum. The frames, constructed of thin steel tubing, are light and strong. The rubber tire has supplanted the iron ring. The saddles, constructed on tension springs, can be used for an indefinite time without chafing.

In nothing appertaining to the Safety has there been so great a revolution as in the tires; for a long time the solid rubber, about ¾ in. diameter, was the only tire for Safeties. Two or three years ago the cushion and pneumatic tires were introduced; the latter is a decided benefit in the reduction of vibration and increase of speed, while the former is considerably better than the solid in this respect.

The previous figures show sections of the three forms of tires:—Fig. 1, the solid; Fig. 2, the cushion; and Fig. 3, the Dunlop pneumatic, all full size; the latter is filled with compressed air. In Fig. 3 the inner ring, C, is rubber; the ring surrounding it, D, is canvas, which allows the inner ring or tube to expand equally round the wheel; the outer crescent-shaped rubber, A, is the tread proper, the thickest part coming in contact with the road; R is the steel rim to which the tire is fastened by cementing the edges of the outer rubber to it.

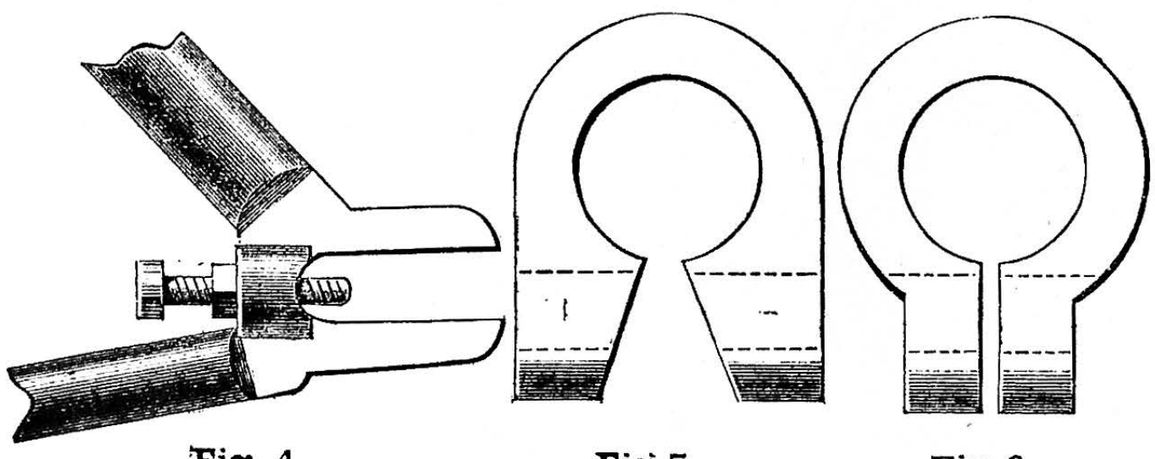

Fig. 4 Fig. 5 Fig. 6

The Cycle. Fig. 4.—Rear Wheel Adjustment Screw (half full size). Figs. 5, 6.—Handle-Bar Clutch (half full size).

The driving mechanism commonly in use on the Safety is an open link chain running on two cog-wheels, one on the rear hub and the other on a short axle situated a few inches in front of the driving wheel, and about 12 in. from the ground; on this shaft are fitted the cranks, and on them the pedals. An essential feature in the Safety is the gearing-up by means of the relative difference in size of the two cog-wheels, which gearing-up compensates for the small driving-wheel, as it may be geared to equal, or more, the largest Ordinary, some racers being geared as high as 70 in. or 80 in. Such is a brief outline of the Safety bicycle. Now for its worth commercially to the nation.

It would be difficult to name a branch of trade that has grown so rapidly as the cycle trade. Within the last seven or eight years hundreds of persons have embarked in the trade, either as makers or dealers. Millions of capital are now sunk in buildings and machinery for their production, while many thousands of persons are employed in the trade. It is estimated that nearly 200,000 Safety bicycles were made in 1891 in this country, and the present year has seen even a greater development of the trade, as many makers have had to extend their premises and employ additional workmen to cope with increased business.

Cycle production carries a number of other trades in its train. First of all, the makers of steel tubes, steel stampings and castings, steel wire, and other materials, saddlery, bell-making, lamp-making, enamelling, electro-plating, transfer printing, and very largely rubber tire-making and other rubber fittings, oils, varnishes, lacquers, cements, and solutions. The press also has its share of work in sending out numerous publications entirely devoted to cycles and the trade. Again, engineers and machinists do a large trade in making machines and tools for the cycle maker. The gas companies even benefit by it, as a large amount of gas is used for enamelling, stoves, blowpipes, and lighting purposes.

The benefits or worth of the cycle to the nation could not well be summarised in a short paper like this. Suffice it to say that the trade has developed and gone up with astonishing rapidity—the present year more so than any former year—and there is every assurance that the trade will go on increasing.

As to the worth of the cycle to the nation derived from its use, it is estimated that in this country some 800,000 persons use the Safety bicycle, to say nothing of a large number of tricycles and a good many Ordinaries.

As a vehicle for pleasure it is used for touring, holidaying, for racing on path and road. It is used by the military, the police, the post-office, the tradesman, the doctor, the clergy, the sportsman, the photographer, the mechanic, the labourer, and the collier.

It is used in almost every country on the globe, and in most out-of-the-way places, such as Malta and the Isle of Man. It is used by all classes of persons, from kings and emperors down to the collier, and of all ages, from seventy-five down to the latest disciple of the wheel, the infant King of Spain. It is used by thousands who do not possess a machine, but hire one at 9d. or 1s. per hour in the evening, when work is done, and by this class, it may be said, it is considerably ill-used.

As a practical repairer of the Safety bicycle, the writer has daily opportunity of noting certain details in the construction of even high-class machines that might be improved; and he would here respectfully throw out the following hints to makers:—All set-screws, such as are used to fix handle-bars and seat-pins, should have square heads, each of the four sides being not less than ⅝ in. A six-sided pin or nut that comes often under the wrench is an abomination. All rear wheel axles should be screwed ½ in. Whitworth; all front wheel axles should be screwed ⅜ in. Whitworth. Mud-guards should be attached to the frame by bolts and nuts, or studs and nuts. Front mud-guard should be fixed to fork crown with a bolt and nut. The best chain adjustment yet invented is that shown at Fig. 4, and is used by some makers; it is always effective, never gets out of order, and never gets lost; the screw should have a square head and lock-nut.

Machines made on the socket steering principle should have the column plugged solid, or with heavy tube, for at least 3 in. from the crown upwards.

When a clutch or gland is used to bind the seat-pin or handle-bar stem, it should be made as in Fig. 5, and not as in Fig. 6. Handle-bars made of ordinary ¾ in. steel tube should have 5 in. or 6 in. of their centre plugged with a bit of ⅛ in. tube to strengthen them at the T attachment. The stem should not be attached to handle-bar by lapping round, but by a T-piece stamping, and the tenon on the T-piece to receive the stem should not be less than 1 in. long.

In making plunger-brake work, the tube carrying the spoon should not be less than ½ in., with a ⅜ in. rod to brake lever; the tube should be plugged solid, 3 in. long from the spoon upwards.

The handle-bar of a racing machine should not be more than 18 in. or 19 in. across the tips of the handles, as racers seldom use the handles, but grip the bar nearer the head. The long handle-bar is a frequent cause of locking and spills.

Direct spokes for wheels, unless they are butted, should not be less than No. 11 gauge, and should be of the best steel wire.

Hubs should always have gun-metal flanges to receive the spokes, as there is in the softer metal a certain amount of give when the strain of driving is on, and the spokes do not snap off so readily as with steel hubs.

In concluding this paper, it may be mentioned that the present season has witnessed a new form of cycle, which bids fair to rival the Safety; it is called the Geared Ordinary. It resembles the old Ordinary in that the front wheel drives as well as steers. It has a gearing-up mechanism secreted in the hub, by which a small wheel can be geared up to any desired extent. It has been tested as to speed alongside the Safety, and quite equals that machine; but whether it or some yet uninvented cycle will drive the handy little Safety to the wall remains to be seen.

SCIENCE TO DATE.

Electricity.—The United States Government have supplied one of their iron war vessels with four electric fans for the purpose of blowing away the smoke from the guns when in action.

Analysis of Organic Compounds.—A more rapid process of analysing organic compounds than the usual method of combustion with cupric oxide has been worked out by M. Berthelot. It consists in burning the compound to be analysed in oxygen gas compressed to 25 atmospheres. The operation is carried out in a calorimetric "bomb," and the products of combustion are then sucked out and drawn through the usual absorbing tubes. The combustion is total and instantaneous, and gives accurate results.

Ammonia in the Air.—M. Muntz has come to the conclusion that the rain water of tropical regions is always more highly charged with ammonia than the rain of temperate zones. In arriving at this result he insists upon the fact that observations made in the neighbourhood of large towns are unsatisfactory, for the atmosphere above a large town is always highly charged with ammonia and other impurities.

Acetic Acid.—The specific gravity of a solution of acetic acid in water at 15° C. rises gradually with the strength of the solution till it reaches 1·7048, which is the specific gravity of a solution containing about 80 per cent. of acetic acid. From this point as the amount of acetic acid increases the specific gravity falls until it reaches 1·0553; this, the specific gravity of the anhydrous acid, being the same as that of a solution containing only 43 per cent. If, then, a sample of acid has a specific gravity above 1·0553—say, *e.g.*, 1·0674—it may be of two strengths, in this case either 94 or 58 per cent. To decide which, water must be added and the specific gravity again determined. If a rise is found, then the acid was of the higher percentage; a fall would indicate a weaker solution.

New Artificial Musk.—A short time ago tri-nitro isobutyltoluol was introduced by Baur as an artificial musk. Para-isobutylxylol sulphonate is now recommended by Valentiner as possessing the advantage of being soluble in water instead of being an oil like tri-nitro isobutyltoluol. It is prepared as follows: A mixture of isobutylic alcohol and aceto-xylol is mixed in molecular proportions. The mixture is then treated with concentrated sulphuric acid, and the whole is thrown into four times its weight of water. A red watery solution is obtained with an oil floating on it. The solution is separated, and on saturating it with common salt the para-isobutylxylol sulphonate is precipitated in white crystals.

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TRADE: PRESENT AND FUTURE.

*** *Correspondence from Trade and Industrial Centres, and News from Factories, must reach the Editor not later than Tuesday morning.*

JEWELLERY TRADE.—The London jewellery trade is almost at a standstill, except, perhaps, a small demand for turquoise work.

CUTLERY TRADE.—The Sheffield pen- and pocket-knife trades are in a poor way.

SILVER TRADE.—The silver trade of Sheffield shows a slight improvement. Messrs. Walker & Hall have completed extensive alterations, and Messrs. Mappin & Webb have opened their new show-room.

EDGE TOOL TRADE.—Most makers are busy. In shipbuilding and kindred tools there is not a good demand. A better market is being opened up in South America.

FILE TRADE.—The Sheffield file trade is not brisk, but a good trade is being done by some houses.

BOOT AND SHOE TRADE.—The production in the great manufacturing centres is not up to the average for August. The London bespoke trade is good.

GOLD THREAD TRADE.—With a fall in the value of the rupee to 1s. 2⅛d., no improvement can be expected in the Indian branch of this trade. The home trade has not yet recovered from the effects of the General Election and the summer holidays. A slight improvement is shown in spangled and frosted thread orders.

WATCH TRADE.—A severe time of depression is being felt at Coventry and Birmingham. For the last two months the larger firms have been running short time, and further reductions are likely.

GENERAL PRODUCE.—Our Liverpool correspondent writes:—There has been some business done in New Para rubber at 2s. 9½d. per lb., but the market is quiet. African rubber has brought very steady prices, but in Sierra Leone, Gambia, and South Coast kinds comparatively little has been done. The sales, which amount to about 30 tons, include Addah niggers at 1s. 7¾d., Accra and Cape Coast biscuits at 1s. 7d. to 1s. 9d.; Sierra Leone twists at 1s. 6d. to 1s. 9d.; ordinary Cape Coast, 1s. 2d. to 1s. 2¼d.; small tongue at 1s. 1d.; Grand Bassam, Axim, and Assinnee at 1s. 2d. to 1s. 4¼d.; gum Arabic, Turkey, 150s. to 200s. per cwt.; East India, 15s. to 80s.; Barbary, 42s. 6d. to 45s.; Gedda and Talca, 40s. to 45s.; Glazirah, 50s.; beeswax, Chilian, £5 5s. to £7 5s. per cwt.; African, £4 15s. to £6 15s.; American, £6 to £6 15s.; West India, £5 10s. to £7.

COTTON TRADE.—The depression in the cotton trade and the remedies proposed continue to occupy the attention, not only of the employers, but also of the operatives. The latter appear to fully anticipate a severe struggle before very long.

CYCLE TRADE.—There is a lull, and large stocks are offered at great reductions. Trade for 1893 is making a move, the Whitworth firm having booked for next season about half their estimated output. With regard to the new geared ordinary, the trade will be quite safe for another season with the safety, especially the pneumatic safety.

IRON AND COAL TRADES.—The iron and coal trades of Sheffield show most decided signs of improvement. It is highly improbable, even in the face of the resolution of the Miners' Federation respecting the discontinuance of the "stop-day" movement, that coal values will be reduced during the next month. The hematite market is so firm that prices must go up with any large increase of orders. An advance of 1s. 6d. per ton has already taken place, making the price in this district from 58s. to 60s. per ton. The demand for Bessemer material is increasing in firmness, and stocks of hematites are very low. Taken altogether, the prospects point to a renewal of prosperity in the iron trade. House coal is quoted at the pits at from 9s. 6d. to 11s. 6d., steam coal 9s. to 9s. 9d., and manufacturing coal is in steady demand. Slacks are quoted at from 5s. to 6s. per ton, and smudge and other small coal are firm.

SHIPBUILDING TRADE.—Shipbuilding in the Mersey district shows no signs of returning activity, while in the Barrow district no new orders have been booked lately, either in the shipbuilding or marine engineering branches.

ENGINEERING TRADE.—The improvement in the Manchester district continues, and in more than one instance some good orders have lately been secured. Some machine tool makers are fairly busy, also the larger makers of stationary engines. The locomotive building trade is worse. Machinists are only in exceptional instances well employed, and boiler makers are still far from busy. In the Tyne and North-east Coast districts trade is fair. Engineers have met the employers half-way in the proposed reduction of 10 per cent. Engineering work is very brisk in Aberdeen, but the pay is poor. Boiler makers have a fair share of work.

STONE TRADE.—The master masons and granite workers of Aberdeen have refused ½d. per hour asked by the men. The standard rate of wages is: stonecutters, 6½d., and masons, 7d., per hour.

BUILDING TRADES.—Our Rochdale correspondent writes:—The strike of plasterers continues. The masters have offered the extra ½d. per hour on condition that the men walk home in their own time on Saturdays. This they decline to accept, as also the masters' offer to submit to arbitration.

FLANNEL TRADE.—The quantity of flannel manufactured during the last twelve months is much less than in the preceding twelve months, and there seems little prospect of pulling up.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

I.—LETTER FROM A CORRESPONDENT.

Norwegian Carving.—R. B. P. (*Dartmouth Park Road*) writes:—"A friend has just sent me an old Norwegian carved box (exact age uncertain) which offers a good design for wood-carving. I send rubbings of the top and side, which show the ornament, and which, though rude in execution, is very effective. The box opens by a sliding lid, indicated on the rubbing."—[We are obliged for these carving rubbings, which are spirited and interesting. We wish more of our readers, scattered as they are far and wide, would go to the pains of sending us a sketch, rubbing, or small photograph of any quaint piece of wood, stone, or ironwork having architectural, legendary, or antiquarian interest. There must be thousands of quaint bits of this character stowed away in remote corners which would be none the worse for seeing the light of modern days. Should sufficient reach us we might be justified in issuing it in a supplement form instead of in "Shop." ED.]

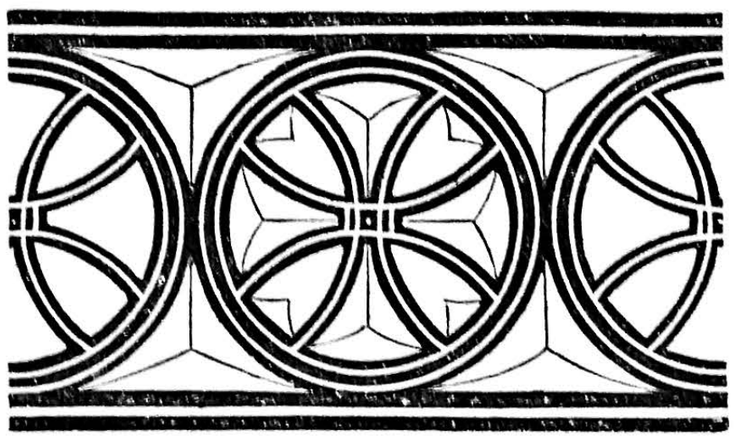

Fig. 1.—Side of Box.

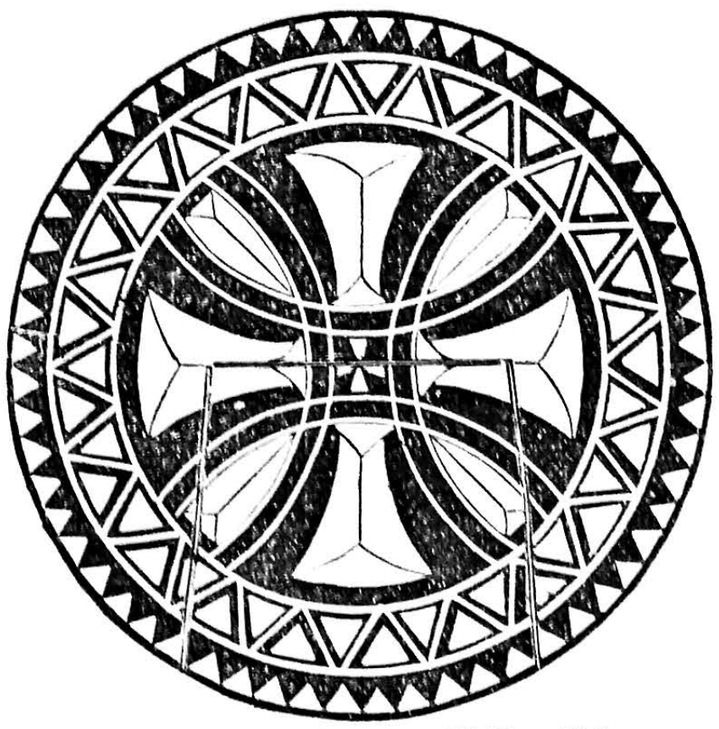

Fig. 2.—Top, showing Sliding Lid.

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Fixing Crayon Drawings.—W. E. R. (*East Grinstead*).—If the drawings are in the ordinary black and white crayons, which are comparatively hard, the fixing may be accomplished by any of the methods below without much detriment to the artistic effect of the drawing; but if it be a highly-finished work in the soft velvety crayons which are used for the best class of such work, there is a very great danger of reducing the effect of the picture in fixing it. The tints will be degraded, and the relation between light and shade to some extent disturbed. All the methods consist in fixing the chalk to the paper by the application of weak gums. The drawings would be destroyed if the liquid were applied, like varnish, by means of a brush on the front of the picture, so, in the first process, the picture is placed on a table with the crayoned side downwards, and the liquid applied at the back, and allowed to penetrate through the paper to the colours. Several coats may be necessary, with an interval for drying after each application. The liquid used consists of 1½ oz. of best isinglass dissolved in 5 oz. of distilled vinegar, and then added to a quart of hot water. A portion of this liquid, after being filtered, must be mixed with an equal quantity of spirits of wine, and is then ready for use. A weak solution of isinglass with alum added is also recommended for fixing the drawing by immersion—that is, by dipping the drawing into a flat dish filled with the solution. This can be repeated until the colours are found to be secure, and the picture can then be varnished. A third method is to distribute the fixing solution in a fine spray over the surface of the picture by means of one of the common glass scent-sprays; while a fourth method, described in a well-known handbook on the subject, is by steaming the back of the drawing through a perforated rose like that of a watering-can. The directions given are to put 2 oz. of spirits of wine with 2 drs. of powdered sugar-candy into the vessel, and on heating this, to direct the steam over the back of the drawing. For myself, I should feel doubtful about the effect of heating spirits of wine in this way. I have not thought it worth while to give more recipes for the preparation of the solutions, for I have no doubt that if DRAUGHTSMAN went to a good oil and colour shop and stated his requirements, he could buy a transparent paper varnish better and cheaper than he could make it.—A. B.

Bedstead.—JOAN.—The iron is chilled in casting, and you cannot soften it. Better leave it alone or buy a new bedstead.—J.

Suggestion for Cowl.—W. H. M. (*Leeds*).—Your idea of running a cowl upon balls is impracticable, and your tinsmith friend could have told you as much if you had referred the matter to him. I will, as briefly as I can, give some reasons for my decision. In the first place, the cost would be much greater. The extra work in making and fixing the three annular rings or webs, as you term them, would, I am certain, be more than the cost of the ironwork for the cowl. We then have the cost of the balls to deal with. By your plan you only provide for four balls in each space, four for the cowl to run on, and four to keep it away from the side. This is not nearly enough. It would be if your idea of partitions to keep them in their places were admissible; but it is not, for the balls would grind against these, and stop the cowl, especially when it got a little dirty. So, you see, it would require two rows of balls not less than ¾ in. diameter. Now, I imagine (and if I am wrong in this, I trust some authority will correct me) that ¾ in. steel balls, perfectly true and hardened, could not be bought under 6d. each at the very lowest, and the quantity required to nearly touch all round the outside of a 9 in. chimney would be over thirty, and as twice that number would be required, that would mean 30s. Then, again, the noise it would make running round would be very great, and cause annoyance; smoke and soot would gain access to the balls, and rust and clog them up. You have made no provision for taking to pieces, nor have you shown clearly how you propose to put it together. It is very easy to draw a plan and section on paper, but quite another thing to make an article like it; and I can see difficulties in construction that it is scarcely necessary to enlarge upon here. Revolving cowls have always been, and, I fear, still will be (even the very best of them), a trouble and a nuisance.—R. A.

Covers and Binding for WORK.—J. G. (*No Address*).—The covers are 1s. 3d. each, the cost to bind 1s. 9d., or, including case, 3s.; carriage to and from London additional.

Three Manual Organ.—F. A. (*London, W.*).—I am afraid that the organ of three manuals and thirty-four stops which you propose to build would prove a costly failure. Reeds cannot be combined with organ-pipes so as to give satisfactory results. It is much more than a question of more frequent tuning, which will not get over the difficulty, as you appear to think. The body and quality of tone derived from reeds are so different from the sounds given by pipes that the two will not balance or sound well together. Before giving credence to all the statements of makers of American instruments, it would be well for you to examine the instruments, and in most cases you would find that, where reeds are stated to be combined with pipes, the so-called pipes are merely very short tubes placed in connection with the reeds, and are in no sense organ-pipes. It stands to reason that if reeds could be efficiently substituted for pipes, the plan would long ago have become pretty general. It has been tried thousands of times, but has been abandoned. The firm you mention has, I believe, combined pipes with reeds on one of their instruments, but I have always understood that they do not stand in tune. I am open to correction if this is wrong. I would urge you not to divide your stops in the centre; it is a most unsatisfactory arrangement on any instrument, and would long ago have been abandoned were it not that so many people think the number of stop-knobs the chief indication of the value of the instrument. If you are so very anxious to use reeds, I would advise you to place them on one manual only, so that you could use them separately when not available with the pipes. You would thus have an organ and harmonium combined in one case, but

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he occasions on which they could be used together would be few and far between. If, as appears from your letter, the cost of pipes puts it out of your power to acquire them, I would remind you that very satisfactory pipes can be cheaply and easily made of paper. You do not say how large your room is; but I note that the space in which the organ is to stand is only 9 ft. 6 in. high. In these circumstances, it would be absurd to think of having stops of 32 ft. tone, as it may be taken as an axiom that if there is not room for pipes of the requisite size, there is not room for stops of the tone they would give. In conclusion, I would strongly advise you to make yourself better acquainted with the subject of organ building, and then re-cast your scheme in the light of the knowledge thus attained. The task you have set yourself is of much greater magnitude than you think it.—M. W.

Combined Chest of Drawers and Bookcase.—S. P. (*Sunderland*).—If you procure the index of each volume of WORK, you will then be in a position to note the numerous designs for bookcases and drawer chests which have from time to time been placed in "Shop" and elsewhere. It will need nothing more to fulfil your desires, as I interpret them, than to select the upper portion of one of the bookcases, and materialise it as a separate carcase placed upon a rather shallow chest of drawers.—J. S.

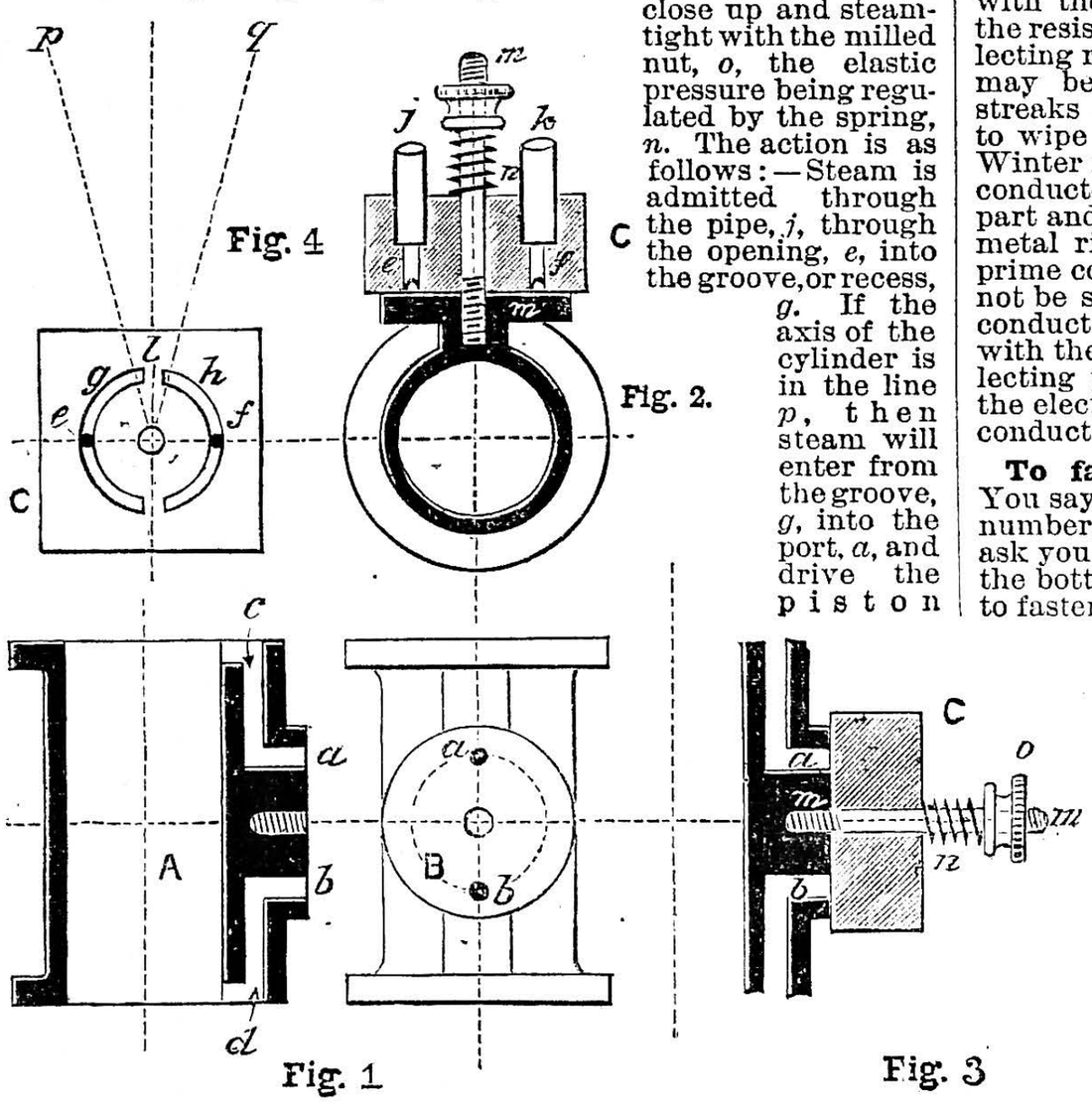
Electric Bells.—R. M.—(1) Arrangement of bells as shown in your diagram is named arranging in series. As trembling bells can rarely be got to beat in unison, the result of this arrangement would be unsatisfactory. If arranged in parallel to all ring at once, the No. 2 Leclanché cell will not furnish enough current. (2) If the bells are arranged as directed below, a battery of four No. 2 Leclanché cells will be sufficient. (3) Three of the ordinary trembling bells will do without any alteration except that of adjusting the contact screws to get best effects. (4) It does not matter in the least which way the current goes from battery to bell, providing all are connected on the same system to one battery. I think you will find the following arrangement suitable for your requirements. Have a bell on each floor, and a separate pressel in the office for each bell: No. 1 bell on top floor; run a wire from battery to bell, then back from bell to push, and wire from this to battery. No. 2 bell on next floor; run a branch from main wire into bell, then a separate wire back to a separate push, and connect this to wire from push No. 1. No. 3 bell on lower floor; connect by branch to main as No. 2, then wire back to office to separate push, and from this to wire of No. 1 push. By this arrangement you can signal the foreman on each floor by pressing appropriate button, and your bells will keep in order a longer time than by any other arrangement.—E. E. B.

Electric Gas-lighter.—GAS-LIGHTER.—Your gas-lighter is a modification of the ordinary electric gas-lighter with two cylinders, and is constructed on similar lines to that of a frictional electric machine. The revolving disc of hard rubber or vulcanite is an adaptation of the same principles of construction as those employed in the plate electrical machines, the brass quadrant taking the place of the brass or tinfoil sectors on one of those machines. The little brass knobs or rivet-beads in the upper fixed disc are probably knobs or knots of wire cord, which must touch the brass quadrants of the disc below, and thus perform the part of collectors. If you fasten on the little triangular pieces of brass to the disc again as they were before, I think you will find the machine work all right, for all the other parts appear, from your letter, to be properly connected. The brass quadrants are not to be connected by tinfoil.—G. E. B.

Motor or Engine to drive Two Lathes.—F. S. *Pimlico*).—You ask for instructions for making an engine to drive two lathes. The ¼ horse-power engine described in Nos. 106, 110, 121, 125, 131, 136, 145, 149, would drive them if they are not more than about 5 in. centres, and if you used a pressure of not less than 50 lb. or 60 lb. per square inch. But as you still ask for instructions, and can hardly expect eight more articles to be written on a larger engine, could you not use the directions given for the ¼ horse-power engine, enlarging them by one-half so as to make the cylinder 3 in. in diameter instead of 2 in.? Thus you would have an engine of ample power.—F. A. M.

Observatory Hive.—F. E. (*Kerry*).—I conclude you want to see as much as possible of the working of the bees in the observatory hive you propose to construct. You must remember that an observatory hive is a very bad domicile for a stock of bees, and the better it is for observation the worse it is for the bees. You might make a box of glass something like an aquarium, 14½ in. long, 15 in. wide, in. deep, inner measurement, without top or bottom, and it would accommodate the ten frames you require, but the work carried on between the combs would be quite beyond your vision. The best plan would be to confine your attention to a hive capable of holding only three or six frames, and make them to hang one deep, so that you could see both sides of the combs. I cannot refer you to the exact number, but in a former number of this magazine I described the construction of such a hive in "Shop." If you look through the index of the last volume you will find it easily. My back numbers are inaccessible at present.—APIS.

Double-Action Cylinder.—W. W. (*Gravesend*).—Figs. 1 to 4 illustrate the method of making steam and exhaust ways in cylinder and steam block. Fig. 1 illustrates the cylinder in longitudinal section, A, and in plan view, taken upon the port face, B. Port openings *a* and *b* are drilled in the face, B, to meet the steam ways, *c*, *d*, drilled through the passage block cast upon the cylinder body. Fig. 4 shows the steam block, C, in face view. It is also seen in its relation to the cylinder in Figs. 2 and 3, with which it must be compared in the following description. The block is pierced with two holes, *e*, *f*, in communication with the steam inlet pipe, *g*, and the exhaust pipe, *k*, respectively. There are two grooves, *g*, *h*, nearly, but not quite, semicircular in the face of C, the grooves stopping short of the centre line to leave a little bridge of metal, *l*, *l*. The face, B, of the cylinder is held against the face of the steam block, C, with a pin, *m*, tapped into B, and passing freely through a hole drilled in C, and kept close up and steam-tight with the milled nut, *o*, the elastic pressure being regulated by the spring, *n*. The action is as follows:—Steam is admitted through the pipe, *j*, through the opening, *e*, into the groove, or recess, *g*. If the axis of the cylinder is in the line *p*, then steam will enter from the groove, *g*, into the port, *a*, and drive the piston *downwards*. The axis of the cylinder will move round towards the line *g*, and the steam will be cut off at the upper bridge, *l*. At the same time, whatever steam was in the bottom of the cylinder will be exhausting into *h*, out at *f*, and away through the pipe, *k*. As the axis of the cylinder goes on towards the line *g*, the port, *b*, will be coming over the recess, *g*, and steam will enter at the bottom of the cylinder, driving the piston *upwards*, and the steam above the piston will exhaust into *h*, and so out at *f*. This is the cycle of operations in such an engine—if we may dignify a toy by such a term. A correct model of a slide-valve engine would, however, be more worthy of the attention of the readers of WORK.—J.



Double-Action Cylinder. Fig. 1.—A, Section of Cylinder; B, Plan of Port Face. Fig. 2.—Cross Section through Centre of Cylinder and Steam Block. Fig. 3.—Longitudinal Section through Cylinder Ports and Steam Block. Fig. 4.—Face of Steam Block.

Armstrong Glass.—JERSEY.—The only address I can find is Armstrong Glass Co., Albion, Birmingham; but I should think this will find them.—L. W. F.

Poster Painting.—S. J. H. (*Leicester*).—Articles on this subject will be taken in hand at once, and will shortly appear.—H. L. B.

Printing Transfers for Pottery.—A. E. S. (*Glasgow*).—The inks used for printing these are, I believe, made in the same manner as ordinary china-painting colours, and thinned to the proper consistency with boiled linseed oil. The common blue is stated to be made with oxide of cobalt, ground flint, and sulphate of baryta, fused together, reduced to powder, and mixed with a flux of ground flint and thick glass powder. I am not aware that the paper used is anything more than a thin, unglazed, yellowish paper, and imagine that A. E. S. will find preparing these inks a thing which no amateur can hope to do successfully.—S. W.

Fixing Cloth on Iron.—LUDLOW.—The property of doing this is claimed for Le Page's carriage glue. Try it.—M. M.

Upholstery.—J. A. S. (*Nottingham*).—Much on Upholstery has already appeared in WORK. Consult indices to Vols. I., II., and III. When a thoroughly competent man presents himself, the subject shall be treated in every branch.

Frictional Electricity.—J. W. T. (*Huntingdon*).—It is difficult to say what causes the escape of electricity you complain of. See that you have a good earth contact by means of a suitable length of brass chain or spirals of wire attached to the gas-pipe of the room in which the machine is worked. If you darken the room you will most probably be able to detect the weakest part of the machine. See that the rubbers do not press too hard against the plate, and bear in mind that a high rate of speed develops only a small amount of electricity, a large machine requiring to be turned slower than a small one on account of the greater surface area. The amount of electricity developed depends largely upon the state of the atmosphere, as a damp or wet day will be found to exert a marked influence on the quantity developed. Are you sure that the machine is entirely free from dust? Electricity is continually attracting dust from the air, and these dust particles act like so many points or vehicles for the escape of the fluid. Use fresh clean amalgam of good quality, and not too hard, with as little grease as possible: only just sufficient to cause the amalgam to adhere to the rubber—ordinary raw suet will answer the purpose very well. When too much grease is used with the amalgam, it will be liable to cause the electricity to be carried round with the plate, as it will be unable to overcome the resistance by leaping on to the pins of the collecting rings. The presence of an excess of grease may be known by the appearance of metallic streaks or rings on the plate; it is, therefore, wise to wipe these away as soon as they appear. The Winter ring is merely an enlargement of the prime conductor, and, to all intents and purposes, forms part and parcel of the latter; consequently, the large metal ring must be in metallic contact with the prime conductor and its collecting rings, but it need not be soldered. All the brass work of the prime conductor should be lacquered with good lacquer, with the exception of the extreme points of the collecting pins; these should be left bare, otherwise the electricity will not pass, as the lacquer is a non-conductor.—C. A. P.

To fasten Soles, etc.—T. M. A. (*London*).—You say you are a reader of WORK from the first number, therefore it will not be troubling you to ask you to turn up No. 137, Vol. III., and there, at the bottom of the first column, page 516, "The way to fasten the felt in" is explained. Your next question, "How to fasten the sole to the welt without showing any traces of it when the boot is finished," I will briefly answer, for it is very simple. When you place the sole on the boot, it should be mellow (damp), and by pressing with the thumb and finger of both hands all round the edge, it can be made a little concave; this, when it is pressed down tight in the centre, will cause it to fit to the welt all round. The edge of the sole can be put just flush with the welt at the toe, and then a tack driven in at the other end (the heel). The boot is then held (heel to the left, toe to the right) on the knees with the left hand, and with the right cut the channel for about ½ in. at the centre of the toe, as shown in the above-named article. Open it, as there shown, and, instead of putting your nail in at A (Fig. 5), put it in these sections of the channel, and, if you like, when you have pared up the edge, you can put another in each side. As to the question whether soles sewn right through are as strong as those sewn in a channel—whichever is adopted, they should be stitched, not sewn. But to answer you will tell a great many readers what they ought to know: and that is, that those stitched through are the strongest, for these reasons—it is the wax and the thread that lay through the sole that give the strength, not, as is often supposed, the stapled end on either side; and also because the channelling reduces the substance that these cross strands have to lie in.—W. G.

Desk Hinges.—EUCLID.—I have inquired of a great many ironmongers and travellers I know, but I have not been able to discover the makers of the hinges you want. Most scholastic furniture makers have their own special hinges, which are made solely for them, and very likely your particular hinge is one of these. One way to treat blackboards is to (1) prime them with a good coat of oil paint in the ordinary way, and then (2) colour them lead colour, rubbing down between each coat; next a (3) coat of drop black, mixed with japan, gold size, and turps, in the proportion of three of gold size to one of turps. After rubbing this coat down, give the boards another coat of the same black, with about one-third of its weight of finest powdered emery mixed with it. I should strongly advise you to keep your back numbers. You would find them very handy at times; in fact, it would pay you to get them.—E. D.

Magnetic Belt.—J. G. (*Edinburgh*).—The magnetic lines of force are always the same from the small magnets in your belt, whether you sweat or do not sweat. It does not need acid nor sweat to make magnets work. This you may find out for yourself if you bring the belt near a small compass, for the needle of this will be deflected by the magnets in the belt at all times, whether the belt be damp or dry. That your feelings may vary at different times I am prepared to admit, but these variations prove nothing in favour of or against the use of the belt. The variations of feelings may be

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due to dozens of causes apart from the belt. The best steel for the magnets of these belts is stiff crinoline steel of hard temper. It is not necessary to have a horseshoe magnet to magnetise these strips of steel. They may be magnetised by stroking them over a bar magnet, and this may be made by enveloping the bar of steel in several convolutions of insulated wire, and sending an interrupted current through the wire. The current from your Leclanché battery will do, and the wire may be of any size from 20 to 30. The north poles, or the north-seeking poles, should point downward.—G. E. B.

Magnetising Steel.—F. J. (*Oldham*).—Steel may be magnetised by three different methods, named respectively single touch, double touch, and electric induction. Magnetising by single touch is effected by stroking the steel with a permanent magnet. The north end of the magnet is placed on the middle of the steel bar, and drawn slowly to one end, then lifted, and again placed on the middle. This motion is repeated several times—say, a dozen or more. The opposite end of the bar is then stroked in a similar manner with the south pole of the magnet. Magnetising by double touch is effected in a similar manner, using two magnets at the same time, placing both on the middle of the steel bar, and drawing them simultaneously to the ends. This method is not only more expeditious, but also makes a stronger magnet. Magnetising by electric induction is effected by winding over the bar several coils of insulated copper wire, and sending a frequently interrupted current of electricity through the coil for several minutes. Steel bars may be easily magnetised by stroking with them the field-magnets of a dynamo electric machine.—G. E. B.

Cleaning Electric Bell Battery. — H. B. (*London, N.*).—You have done quite right in washing the cells in warm water and scrubbing the zinc rods to free them from loose dirt. The ends of the wires should be cleaned by rubbing them with emery-cloth, and the parts of the screws to which these wires are fastened must be cleaned in a similar manner, so as to have clean metal touching in every part. The outer jars are not to be charged with acid, but with sal-ammoniac dissolved in water until the water will not take up any more of this substance. Probably the jars will take 3 oz. of sal-ammoniac to each jar. It is a whitish salt in large crystals, obtainable at any Italian warehouse. No solution is required for the inner cell, as the sides of this are porous, and the outer solution soaks into the pores. If the battery will not ring the bell after being thus cleaned and re-charged, the inner cells may be worn out, and must be renewed.—G. E. B.

Petroleum in Boiler. — "THROUGH." — The boiler described by our correspondent is far too small to be heated by petroleum, otherwise than by a lamp or burner, which will give a local concentrated heat. We should feel inclined to use coke, and turn the exhaust from the engine into the chimney—which is full small for the size of the fire-box—and see what that would do, breaking the coke into pieces of the size of a nut. We believe it might be adapted to burn benzoline with a suitable apparatus, which would generate an intense heat in the box; but this stuff is so highly inflammable and dangerous, that it would require to be in the hands of a manipulator well skilled in its use, to avoid the chance of accident. If our correspondent will try coke with the exhaust into the chimney, and let us know the result, we will then see what is best to be done. Possibly it will be found necessary to use a larger chimney—say, 2½ in.—to obtain the desired result; but the exhaust from the engine with coke should produce better results. At any rate, it is worth trying, and will not make matters worse.—C. E.

III.—QUESTIONS SUBMITTED TO READERS.

*** *The attention and co-operation of readers of* WORK *are invited for this section of "Shop."*

Roller Skates.—J. B. (*Glasgow*) writes:—"Will any kind reader of WORK inform me how to make a pair of roller skates?"

Musical Glasses.—MUSICAL writes:—"Would any reader of WORK kindly inform me what sort of glasses are used for making a set of 'Musical Glasses,' and if they are tuned by putting water in them; and what is the stuff to put on the fingers to make them play by rubbing round the top?"

Razor Setting. — VILLAGE SHAVER writes:—"Will any reader please give me information on the art of razor setting and stropping correctly? Also, where could I procure the necessary materials for above, and the proper method of using the cavalry strop?"—[You should consult WORK, No. 105, page 7.]

Gold and Silver Braid.—ADMIRER OF "WORK" writes:—"Will someone who has had experience kindly advise what is the best thing to clean the silver ornaments and braid on officer's uniform, to give them that beautiful *dead white* appearance; also gold ones; how to apply it, and where it can be obtained?"

Horse-hoof Parings.—M. (*Holloway*) writes:—"Can any reader kindly inform me how to dissolve these, and, if there are different ways, the quickest and the best?"

Canvas Canoe. — W. F. (*Glasgow*) writes:—"Will any reader kindly inform me through 'Shop' how to make a canvas canoe?"

Printing, Paper, Stationery, etc.—G. L. (*Poplar*) writes:—"Will any reader kindly give particulars of a book or books on the above subjects, containing technical terms used in printing, and signs used for alterations of proofs, etc.; and hints how to tell different kinds of paper?"

Wind Wheel Driver.—YOUNG SMITH writes:—"Will some kind reader inform me whether there has been any invention brought out in the way of a wind wheel for the purpose of driving small machinery, such as a small lathe or chaff-cutter, etc.? Plans of same, or the address of makers, would oblige."

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Sash Beads. — NIL DESPERANDUM writes, in answer to H. F. (*Ramsbury*) (see No. 171, page 238): — "I send the following instructions and sketch, the latter not being drawn to any scale:—To determine the necessary bevel at the head for the casement to open, draw a line from the centre of pivot to x, or back of rebate. Then make x y square to this line; this will give the splay required for the casement to clear when opened. To cut the beads, draw the casement when open with bead

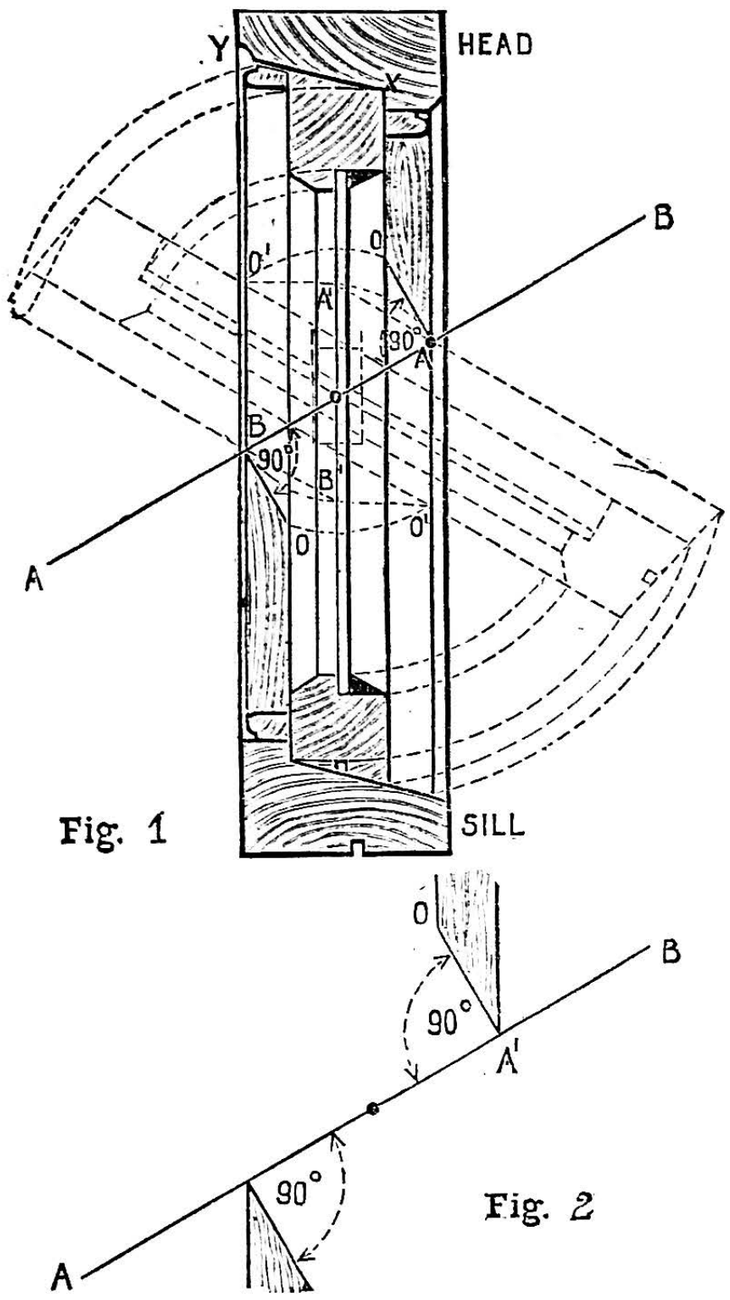

Fig. 1

Fig. 2

Window Sash Plan.

lines on; then from the centre to A draw a line, and make this line, and the line, A O, at right angles—viz., square; B O is the same, and A' O' and B' O' show the points when the sash is open. The portions of the beads shown by the grain of the wood are fixed to sash frame, as also are the outside bead at head, and inside bead on sill. The remaining portions, including inside bead at head (and outside bead at sill, if there were one fixed), would require to be nailed on to the sash itself and to open with it."

H. E. B. Monogram.—W. J. B. (*Londonderry*) writes:—"The monogram H. E. B. (see WORK, No. 165, page 142) was sent for WIN by me, and not by F. J. K. (*Tufnell Park*), as stated."

Drawing.—D. B. Y. (*East Grinstead*) writes, in reply to READER (*Clonmel*), to say he may be able to assist him if he gives more particulars.

Paint.—G. P. (*London, S.E.*) writes to C. J. (*Chester*) (see No. 172, page 253):—"Balmain's luminous paint is on sale at the Crystal Palace. An agency has long been established there."

V.—LETTERS RECEIVED.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—SPIRITS; E. D. (*West Kensington Park*); PHONO; W. W. (*Gravesend*); J. H. (*Bradford*); W. MCS. (*Glasgow*); LEO; A. L. C. (*Camberwell*); A. W. R. (*Kilburn, N.W.*); V. W. (*Dewsbury*); R. T. (*Barnsbury*); C. E. F. (*Clapham, S.W.*); W. S. L. (*Canning Town*); J. S. Q. (*Paris*); H. G. C. (*Axbridge*); J. W. M. (*Birmingham*); H. S.; J. P. (*Newcastle*); PORZEE; C. R. (*Acton, W.*); W. A. (*Nacton*); T. P. (*Bray*); A. D. S. (*New Brighton*); A. T. (*London, N.*); A. S. A. (*Aberdeen*); W. N. (*No Address*); H. S. A. (*Crewe*); W. M. (*Saltley*); W. B. (*Northam*); P. K. (*Gateshead*); PAINTER; E. L. (*Wakefield*); YOUNG SPORTSMAN; FISH; JOINER; J. W. B. (*Castleford*); OXY; TRY AGAIN; J. B. (*Widnes*); W. J. D. (*Manchester*); F. P. (*Bristol*); HIGH PRESS; J. B. (*Ashton-under-Lyne*); ZETETIC; A. M. R. (*Golden Square*); M. A. & Co. (*Nottingham*).

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All manuscripts intended for the "Escape from Fire Device" Competition must be addressed to the Editor of WORK, c/o Cassell & Co., Ld., Ludgate Hill, London, E.C. They must reach him on or before Saturday, August 27, endorsed, "Escape from Fire Device" Competition.

NOTICE TO READERS.

NEXT Week's issue (No. 181) will contain, among other interesting articles—

JEWELLERS' ENAMEL AND ENAMELLING.
HOW TO MAKE A CHECK CASH TILL.
STAGE DRAPING AND DRAPERIES.
DIVIDING FLOWER TUB.
BACHELOR'S BOOKCASE.
CLEADING VERTICAL BOILERS.

*** The Editor makes this intimation in the hope that readers, having friends interested in any of these subjects, will bring the same to their notice.

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